THE AMERICAN GAS LIGHT JOURNAL

PUBLISHING OFFICE No. 32 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME LV.—No. 4. Whole No. 842. | NEW YORK, MONDAY, JULY 27, 1891. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
JOS. R. THOMAS, C.E., Editor. T. J. CUNNINGHAM, Asst. Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y. AS SECOND CLASS MATTER.

Published on each Monday of the year, at No. 32 Pine Street, N. Y.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $4.50 (19 shillings—22½ francs). All payments to be made in advance. Single copies, 10 cents.

Remittances should be made either by post-office order, express money order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

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CONTENTS.

An Asterisk (*) denotes an illustrated article.

EDITORIALS—

Briefly Told 109

An Old Scheme in a New Dress.—Not so Bad as at First Reported.—Destruction of a Gasholder.—Gas Doings at Clinton, Iowa.—Notes.

The Market for Gas Securities 110

Coal Storage, by Mr. J. McGilchrist 110

Timber Piling in Foundations and Other Works, by Mr. H. Adams, ... 111

The Ultimate Composition of Some Alabama Coals, by Mr. Wm. B. Phillips, Ph. D. 113

*The Colorado Automatic Refrigerator System, by Mr. A. McL. Haws, C.E. 114

Electric Gas Lighting Apparatus 115

*Thirty-Horse Four-Cylinder Gas Engine, Adam Type 116

The Mines' Law of Alabama 117

The Electric Light in Paris 117

Special English Correspondence 118

Gas Affairs at Manchester.—New Projects.—The Capital of Gas Undertakings.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES 119

Annual Meeting, Duluth, Minn.—Mr. Egner's Home Address.—Lowe Apparatus for the Equity Company, Brooklyn, N. Y.—A Line or Two from Columbus, Ga.—Col. Coveney Succeeds the Hon. A. B. Coffin on the Massachusetts Gas Commission.—Improvements at Dover, Del.—Mr. Raynor Looks in on Us.—Mayor Washburne's Veto.—Inspector Brown on the Public Lighting, San Francisco.—Public Lighting, Youngstown, Ohio.—Mr. Stiness Again Heard From.—Annual Meeting, Ashland, Pa.—A Pleasant Affair at Portsmouth, Ohio.

Prevention of Firedamp Explosions 121

BRIEFLY TOLD.

AN OLD SCHEME IN A NEW DRESS.—A correspondent at Valparaiso, Ind., writing under date of the 16th inst., says: "I send you under separate cover some copies of the Chicago *Tribune*, of July 5th and 12th, with marked articles relating to gas matters. I think you are in error regarding that 15 cent gas, mentioned in your issue of July 13th, as to place of location. The works are at Deering, a suburb of Chicago, located on the Northwestern Railway, not so far out as Waukegan. I think this is the same old scheme that was tried at Defiance, O., a few moons ago. I believe this Hall is an uncle of Miss Proctor, of the famous Proctor process. I was at Defiance while the plant was being erected there, and attempted to have an interview with Mr. Hall, but he was always sick when I called, and I inferred, from the conversation of his foreman, that he was not seeking investigation from practical gas men. I am convinced that the Deering scheme is a bald-headed swindle; and although it is located so close to this city, I have not taken the trouble to look it over. I may, however, do so shortly."

NOT SO BAD AS AT FIRST REPORTED.—Despatches sent from Philadelphia to New York, on the afternoon of the 22d inst., conveyed the shocking information that Mr. W. W. Goodwin, President of the Goodwin Gas Stove and Meter Company, had been stricken that afternoon with paralysis, and that his case was very serious indeed. While it is true that Mr. Goodwin was suddenly stricken down, his marvelous recuperative powers stood him in good stead, and it is with great satisfaction we say that "Goody" will be himself again in short order.

DESTRUCTION OF A GASHOLDER.—A very mysterious explosion case is reported from Rochester, N. Y., where, at midnight of July 15, a gasholder of the Municipal Gas Light Company, located on the Canal street plant, was badly shattered by what undoubtedly was an explosion of gas. The holder had been out of action for something like two weeks, having been let down for the purpose of making some needed repairs to the tank. These had been completed 24 hours before the explosion occurred—in fact, the tank was being refilled. Everything appeared to be going along smoothly—the water works department placed a man in charge of the hydrant from which the tank was being filled, with instructions to turn off the current in case the fire bells proclaimed a fire—when that portion of the city in which the holder was located was suddenly disturbed and bewildered by an explosion of great violence. The holder crown was completely destroyed, as was the trussing, while the columns suffered slight injury. The force and direction of the explosion were almost entirely upwards, none of the fragments of the crown having been discovered at a distance of 50 yards from the side sheets at any point. Two men were killed by the explosion, one of whom was Michael Stapleton, the Company's night watchman, the other being Philip Peterson, captain of a canal boat, whose vessel was lying in the canal which winds along close by the holder side. Peterson was killed by a blow from a flying fragment of iron. We have not received the testimony brought out at the inquest, but it looks as if the inlet valve to the holder, which was still in direct line with the producing plant of the works, either leaked or had been slightly moved from an "off" position. In the meantime, the watchman was

making his round, carrying with him a lighted lantern—it seems it was his habit to lower the lantern through the holder manhole with the object of determining how high the water had risen—and, following his risky style of satisfying his curiosity, paid the penalty. This is the most reasonable explanation of the affair that can at present be given, but we hope shortly to furnish a complete account of the mysterious affair. The value of the holder is put at $60,000.

Gas Doings at Clinton, Iowa.—Mr. S. M. Highlands, Superintendent of the Clinton Gas Light and Coke Company, writing under date of the 22d inst., says: "I inclose you a statement of facts which show in a small way what we are doing here. The city of Lyons, with 8,000 population, and adjoining this city, has granted us a 30 year franchise, and we are now piping it. We will supply it from our present works. We certainly are enjoying a gas boom here, thanks to low prices and good solicitors." The statement referred to by Mr. Highlands is appended: "Few people perhaps realize the magnitude of the improvements that are being made in this city by the Clinton Gas Light and Coke Company. All the principal streets of the city are now supplied with two gas mains, which course was made necessary by the increased demand for gas for lighting and fuel purposes. The two gas generators recently placed in the plant are 32 feet high and 6 feet in diameter. The new gasholder will be 60 feet in diameter and 20 feet in height. The brickwork on the new addition is about completed, and the iron girders for the roof are being placed in position. The cost of the improvements will reach $65,000, and when everything is completed Clinton will have one of the finest gas plants in the West. Since the 1st of May last the Company has set 160 new meters; or, in other words, added 160 new customers to their books. At the present time they have 150 applications from people who are patiently waiting their turn for connections. The Company has a large force of men at work putting in gas fixures. In less than three months the Company has sold 175 stoves, embracing several different grades of both heating and cooking stoves. It is thought that the entire improvements now under way will be completed in October."

Notes.—Mr. William H. Christie, formerly of Akron, Ohio, has been appointed Superintendent of the Corning (N. Y.) Gas Company, and Mr. David Gertin was named as his assistant.——Mr. Geo. A. Yuille has resigned the position of Treasurer of the Chicago Gas Company in order to accept the management of the Economic Fuel Gas Company of Chicago.——On July 15, Mr. John F. Rodgers celebrated his first anniversary with the Decatur Light and Power Company of New Decatur, Ala., which he serves as Superintendent. He ought to feel satisfied with the record so far made by him in this bustling Alabama town. The Company began to supply gas in 1888, and its success was not very flattering to the proprietors, who, on July 15, 1890, found themselves supplying 72 consumers. On the date noted, Mr. Rodgers took command, and at the close of his first year he can and did report 163 meters in service. 20 gas cooking stoves are in use. Next month the Company will bury three-quarters of a mile of 6-inch pipe, which will add 25 more consumers to the rolls, 6 of whom have signified their intention of using gas stoves. Mr. Rodgers has in contemplation the running of a side track to the Company's coal storage house. Take it all-in-all, he ought to be satisfied with his achievements for the twelvemonth.——At the annual meeting of the stockholders of the Consolidated Gas Light Company, held last week, the Hon. James A. Gary presided, and Colonel L. R. Smoot acted as Secretary. The number of shares represented was 65,680, all of which were voted for the following Board of Directors: E. C. Benedict, W. B. Brooks, William F. Burns, B. Cahn, W. S. Carroll, W. F. Fricke, James Spence and George A. Von Lingen. At a subsequent meeting of the Directors, organization was thus effected: President, Capt. John W. Hall; Vice-President, W. S. Carroll; Secretary, Col. L. R. Smoot; Treasurer, Jos. W. Clarke. ——The Berkley and Lorin (Cal.) Water and Light Company has been incorporated by W. L. Sheldon, W. F. Martin, J. A. Mallon, J. Purcell and C. W. Eltving.——At the annual meeting of the Laconia (N. H.) Gas Light Company no change was made in the executive management. A 3 per cent. dividend on the old stock was declared. ——At a first special meeting of the citizens of Wakefield, Mass., a two-thirds vote in favor of directing the authorities to accept the provisions of the legislative act relative to municipal lighting was secured.

The Market for Gas Securieties.

Dull as the few immediately preceding weeks were in the matter of speculation in city gas shares, the past week (without exception) was the champion dull one in the history of the Exchange in respect to the securities noted. Consolidated sold down to 92¼, the opening bid rate to-day (Friday) being 92¼. Of course there is no good reason why these shares should be selling at such a ridiculously low figure, and they are decidedly a purchase for either investment or speculation. Mutual is at 116 bid, ex-dividend, as is Equitable. In Brooklyn shares no change of moment transpired. Chicago gas opened to-day at 48¼, the decline being attributable to the mixed condition of affairs respecting gas charters. Laclede is at 14 to 15½, and Baltimore Consolidated is at 43½ bid.

Coal Storage.

[A paper read by Mr. J. McGilchrist before the Incorporated Gas Institute.]

The theme on which I am to speak is "Coal Storage"—a subject which in the past has not received from Gas Associations the consideration it undoubtedly deserves, but which in the future, both from its own inherent importance and the many risks arising to gas making from industrial disturbances, must demand attention. Mr. Charles Nickson has to-day favored the Institute with a paper on gas workers' strikes; but if he could, along with the Institute, settle the larger question of strikes in other departments of labor as well as those connected with gas workers, it might be unnecessary for me to discuss this question. It seems to me, judging from past and present experience, that there is every likelihood of strikes becoming more numerous in the future than they have been in the past. It has been said that strikes will not cease from troubling the labor and commercial interests of the land until "the lamb and the lion lie down together;" but I am afraid that this happy and blissful period will only come when the lamb has disappeared in the lion.

With regard to the question of coal storage, I do not know that there is any specific rule for the quantity of coal to be stored in proportion to the annual make of gas; but if such a rule exists, I am afraid it is "more honored in the breach than the observance." I know of gas works—large works—where there is practically no provision made for the storage of coal; and I know of other gas works having storage for at least one year's make of gas. The difference between these two cases gives a wide range; and I am afraid the instances where the storage capacity is limited are much more numerous than those where the manager can lay in a large supply, and can say with a contented mind during a strike: "Soul, take thine ease, for am I not bountifully—yea, most bountifully—supplied, and the people verily shall have light?"

We have rules for gas storage in proportion to the maximum make of gas; why should we not have a rule for coal storage? I hold that no gas works are complete with less storage accommodation than would maintain a supply for three months, calculated for the winter consumption of gas. I contend that, if my idea were generally adopted, it would prove not only economical, but would go far to place gas companies and gas corporations above the whims and caprices of trade union leaders, and would enable them to give a constant and efficient supply of gas during any temporary labor dispute.

There are three classes of strikes affecting the gas industry. These may be put down in logical sequence as gas workers', positive; railway, comparative; and miners', superlative. The first of these classes of strikes is, no doubt, troublesome; and, in many cases, most expensive to defeat. But we have been taught by the South Metropolitan Gas Company how the battle can be fought and won. We, as gas managers, owe Mr. George Livesey, Mr. Nickson, Mr. Hutchinson, and others, a deep debt of gratitude for the manly way in which they fought the battle of the gas industry against the Gas Workers' Union. The second class of strikes—viz., railway—affect the gas industry even more than the first, but in a less direct way; because, with insufficient coal storage, unless at enormous expense, it is almost impossible to maintain a constant and satisfactory supply of gas. In Scotland, during the railway strike last winter, the purveyors of gas light were at their wits' end to give even an indifferent supply; and this was only accomplished with enormous mental worry and money expenditure. Three months coal storage would have saved all this; because the strike lasted only for six weeks. In England, too, the same conditions prevailed. A friend in a good sized English town, writing to me on the subject of my paper, says: "For my own part, I can scarcely find words to express the anxiety I endured last winter in consequence of not having a coal store. With the exception of being able to store about 600 tons around the retort house, I was practically dependent upon regular daily supplies. The stock of coal may be kept intact during summer; but in winter it varies from day to day, and especially during any holidays the miners may indulge in. On more than one occasion we had not sufficient coal in stock to last 24 hours." Contractors, my friend goes on to say, were pushed for delivery. But they were unable to respond; and his Committee were compelled to purchase a quantity of coal from other sources at an increased cost of 35 per cent. over their then contract rates. Such is one example of a works without coal storage—perhaps rather an extreme case. But had my friend had ample coal storage, such as he is about to get—and, I may add, "he won't be happy till he gets it"—with what peace of mind both he and his Committee might have persued their labors. As to the third class of strikes—viz., those of miners—although the gas workers and the railway people might be anxious to

assist in maintaining the gas supply, they would be powerless, because if the coal is not raised from the earth they might join that deplorable band of winter gardeners, the refrain of whose ditty is, "We've got no work to do."

Perhaps the greatest objection to supply sufficient coal storage is the cost it would entail. I now propose to show that ample coal storage is not a drag upon the resources of a gas company. Indeed, I believe that in most cases it could be shown to be a clear profit, altogether apart from other advantages. Say that the average cost of coal storage amounted to 36 cents per cubic foot of space, and giving 44 cubic feet to the ton, we get $16.40 of capital charge per ton of coal. With this space occupied twice in a year, we get $8.20 as the capital charge per ton. I now proceed to point out the economies that compensate for this capital outlay. In the first place, let me remark that to insure an ample supply in winter, the coal master must bring his coal outside at the pits, which, of course, is charged on the cost of the coal. This will be at least 12 cents per ton. Again, by its being exposed to the atmosphere, coal undergoes deterioration in a remarkable manner, dependent upon its composition. This deterioration, together with the dross, may be put down at 30 cents per ton. To this sum it would only be fair to add 24 cents for the disadvantages arising from the carbonization of wet coal. This makes a total, under these three heads, of 66 cents per ton—a saving sufficient, under almost any circumstances, to provide ample coal storage. Over and above this large amount, I believe another saving could be effected. If companies were to take their supplies of coal other than in the winter season, when railways are pressed with the maximum traffic, the railway companies would make concessions under the head of carriage, which should also be put to the credit of economies.

In addition to all these pecuniary advantages, no one can overestimate the benefits of carbonizing coal when it is, comparatively speaking, dry. Indeed, I think one of the greatest blots in our system of gas manufacture is the unscientific manner in which we often treat the coal previous to carbonization. It sometimes arrives wet at the gas works, and in this unsatisfactory condition it is frequently thrown into the retorts. The late Dr. Wallace, of Glasgow, in the year 1878, when testing undried and dried coal, found that the latter not only gave a higher illuminating power, but also a much greater yield per ton—equal to fully 10 per cent. The increased sperm value of coal when properly dried is somewhat extraordinary. And here I may parenthetically observe that, so great are the advantages of having the moisture—other than that of composition—extracted from the coal previous to carbonization, that I believe it would recoup the outlay of constructing a flue from the retort bench, under the coal stores, to the chimney stack, so as to attain the end in view. For these and other reasons, to which I need not specifically allude, I think I have demonstrated that no gas works can be in a complete or satisfactory condition without ample storage accommodation.

In these days of the New Trades Unionism it is imperative that gas companies should have sufficient coal storage. We can all remember the time when coal masters "binged" coal at the pit-heads to meet the winter requirements of gas manufactories. Under modern ideas of Trades Unionism the coal master cannot store coal as he used to do, because as soon as a few tons appear in store at the pit's mouth the miners go upon holiday. I know of four collieries in Lanarkshire where the miners acted as I have described.

Such a state of affairs implies a hand-to-mouth arrangement which cannot be pleasant to anyone who undertakes to give the public a sufficient and constant supply of gas. It simply means that if this were the rule throughout the country—and I fear it is fast becoming the rule—the consumption of coal being so much greater in the winter than in the summer months, when the winter arrives there will not be a stock of coal above ground to enable gas manufacturers to maintain a constant supply. This may be all good enough for the miner, who, no doubt, within certain limits, is justified in looking after his own interest; but it is a state of matters calculated to create some concern in the minds of gas managers and their constituents.

Can anyone imagine conditions more appalling than a gas works with a short supply of coal during the dark months of winter? Were companies throughout the United Kingdom subject to such a condition for even one night, the unfortunate results to life and property may be better imagined than described. The fact is, we must have coal; and the only safe way to insure this is to have the surplus coal which is raised from the earth in the summer season stored at our works to meet winter requirements. If we could attain the end I have in view, the coal master would be relieved of much responsibility, gas companies would be greatly benefited, and the public would have no cause to fear an interruption in the supply of artificial light.

Some may object that, by storing coal for the period I have indicated, extra cost would be incurred by the coal master charging interest. But I have it on the authority of certain coal masters that they would be only too glad to increase the term of credit on coal so stored. This I consider no great sacrifice on their part, because they never make bad debts in dealing with gas companies and corporations.

In conclusion, I trust I have laid this subject before you in such a way as may elicit a free and full expression of opinion. If this Institute gives a strong expression of opinion as to the coal storage required at gas works, I believe many suffering at the present time from short storage would easily get the amount they require. In a word, I believe that ample coal storage will conduce to the peace of mind of gas managers, and at the same time keep the miners and other workers in check. The onus of maintaining a suppy of coal during troubled times should not rest on the shoulders of coal masters and railway companies. The proprietors of gas undertakings should bear a fair share of the responsibility; and I hold that the best way to accomplish this is by the provision of ample storage.

Timber Piling in Foundations and Other Works.

By Mr. H. Adams.

Timber trees are known botanically as exogens, or outward growers, because the new wood is added underneath the bark outside that already formed. The whole section consists of—(*a*) Pith in the center, which dries up and disappears as the tree matures. (*b*) Woody fiber, or long, tapering bundles of vascular tissue, forming the duramen or heart-wood, arranged in rings, of which each one is considered to represent a year's growth, and interspersed with medullary rays or transverse septa, these consisting of hard, flattened plates of cellular tissue, known to carpenters as silver grain, felt or flower, and showing most strongly in oak and beech. After the tree is a few years old, the heart-wood becomes comparatively dry and hard from the compression produced by the newer layers. (*c*) Alburnum or sap-wood, which is the immature woody fiber recently deposited. In coniferous trees the sap-wood is only distinguishable when dry by a slight greenish tinge; when wet, it holds the moisture much longer than the heart-wood, and can be detected in that way. (*d*) The bark, which is a protecting coat on the outside of the tender sap-wood. It receives additions on the inside during the autumn, causing it to crack and become very irregular in old trees. The mode of growth is as follows: In the spring the moisture of the earth is absorbed by the roots and rises through the stem as sap to form the leaves; during summer the leaves give off moisture and absorb carbon, which thickens the sap; in autumn the sap descends inside the bark, and adds a new layer of wood to the tree. Timber cut down in the autumn, after the sap has formed the new layers of wood, is best seasoned by cutting it into planks and stacking them horizontally in open order under cover, exposed to a free current of air and protected from ground moisture. Baulk timber is best seasoned by putting it under water in a running stream for a few weeks, then stacking it loosely with some protection from sun and rain. Piles are formed almost exclusively of Baltic fir (*Pinus Sylvestris*), although other timber would be more suitable in some cases if expense were of less consequence. They should always be of whole timber, and may generally be rough hewn, in the log as imported, the size being selected according to the purpose. For small piles small stuff is much better than "broken timber," or timber cut out of larger baulks; it keeps its shape better in seasoning, and is less likely to twist or split in driving. If cut all round so that the heart is left central, the only objection to cutting down large stuff is on the score of expense.

In country districts alder (*Alnus glutinosa*) is favorably looked upon for small piles in wet ground, and where beech (*Fagus sylvatica*) is plentiful it is considered good; but the author has no experience of these for piling. Yew (*Taxus baccata*) grows so slowly that it could never become a popular timber in large scantlings, but there is no English wood equal to it for withstanding the weather. It is, however, rather apt to split, and is better for fencing than any other wood. English elm (*Ulmus campestris*) is very good for foundations in wet soil, or where constantly exposed to moisture; but if alternately wet and dry it will not last. In the latter case oak (*Quercus robur*) is the most durable, and is particularly suitable for detached piles for mooring barges to on a river frontage. Greenheart (*Nectandra rodiæi*) is perhaps the most perfect material for piles, but its cost is prohibitive except where the attacks of marine worms, which greenheart alone repels, render its use essential. Moulmein-teak (*Tectona grandis*) approaches greenheart in its special qualities, but is softer and more apt to split. Pitch-pine (*Pinus resinosa*), from the United States and Canada, may

be obtained from 11 to 16 inches square and 20 to 70 feet long, sawn all round; but it is not favorably received for piling, although it may often be obtained more cheaply than large Baltic fir. It is said to decay rapidly between wind and water, and in damp, close situations, although Col. Seddon ("Builders' Work," p. 123) considers it to be durable, especially when exposed to damp and water. It is not good for beams, although very tough and strong when fresh, because it gets brittle with age, and must be well seasoned or it shrinks considerably. It is almost free from knots, but is subject to cup and heart shakes; its elasticity, strength and durability are sometimes reduced by the practice of "bleeding" or tapping the tree for the sake of the turpentine it contains. Larch (*Larix Europœa*) is a very durable timber, suitable for small piles, as it will stand variations of moisture; in appearance it is very similar to pitch pine, but its qualities are in many respects superior. It bears driving bolts and nails better than any other kind of resinous wood, is tough and compact, and in spite of its resinous character is a fire-resisting timber, similar in that respect to Lombardy poplar, which only smoulders. Good timber when freshly cut appears clear and bright to the eye, and firm and dry to the touch. It should be straight in the grain, with the annual rings uniformly spaced, have a fair amount of resinous matter, a clear sound when struck, and no large diagonal knots. If "waney," a large proportion of sap-wood and a wandering heart may be expected, but timber having this defect may often be used for piles when it would be inadmissable for other purposes.

For permanent use Baltic timber should be partially seasoned or dried, and then "creosoted," or impregnated with oil of tar, this being formerly known as Bethell's process. The usual specification clause is, "The whole of the piles are to be creosoted under pressure with not less than eight pounds of creosote to each cubic foot of timber," but the amount actually taken up will depend very much upon the quality of the timber. For instance, good Memel will take up very little, while coarse Dantzic with a large proportion of sap will absorb a considerable amount. It passes much more freely through sap-wood than heart-wood, and this is fortunate, because otherwise the sap-wood is very perishable, but although the sap-wood is thus preserved it is not made capable of resisting heavy pressure. Timber is not properly creosoted if merely plunged in a tar tank; it should show distinct signs of impermeation when cut through the middle, and this can only be obtained when the creosote is forced through the whole length of the timber, although the more modern plan is to put the timber under a vacuum to draw out the air, and then let the creosote find its way in. In forming joints and scarfs all cut surfaces should be well tarred before being put together, especially on the end grain, and this should also be done upon all top ends when cut off; it is not necessary on the points of the piles, nor upon the heads when merely dressed to receive the hoops for driving. If uncreosoted the material should only be tarred upon the end grain, and then care should be taken that it is as dry as possible at the time, for moisture shut in by tar or paint causes rapid decay. Piles driven in peat or loose ground, where from the uniformity of the soil or the short distance no serious obstruction is to be expected, may be merely pointed with a point one and a half to two diameters long, and driven without the protection of an iron shoe, but through gravel or boulder clay—a shoe weighing from 10 to 30 pounds, and proportioned to the size of pile must be securely fixed on each. These shoes have sometimes been wholly of wrought iron and expensively made; but seeing that they are only used once or twice and are of no further advantage after the pile is driven, the cheapest efficient shoe is undoubtedly the best. Wrought iron shoes have generally one serious defect; they have no flat abutment for the point of the pile, and consequently the pile acts as a powerful wedge to split them open. A square taper cast iron point with recess on each face to receive the end of strap, and four wrought iron straps, form the very simplest shoe; one rough rivet through each opposite pair of straps fixes them securely in the recesses, so that the point cannot turn aside in driving. Two, or sometimes three, countersunk holes in each strap permit the shoe to be fixed on the pile by means of 3-inch or 4-inch town clout nails, or short spikes. The upper part of the cast iron point must be flat and square with the axis, and care must be taken in adzing down the end of pile to fit the shoe that the end of the pile bears well upon the cast iron point when the shoe is in place. The size and weight of the shoe will vary with the size of the timber used. Rankine says the shoe should weigh one-hundredth of the weight of the pile. In Vol. II of Rivington's "Notes on Building Construction" it is recommended that piles should be driven with the butt, or natural lower end downwards, but it is considered by many practical men that when timber is inserted in the ground the reverse way to that in which it grew—*i. e.*, with the butt end upwards, the moisture has greater difficulty in rising in fibers to cause them to rot. But there is another reason for keeping the butt end upwards if the pile is tapered, for by putting the small end downwards the pile is better supported throughout its length; whereas if the larger end is driven downwards, the earth round the sides is not so firm against them. To prevent the timber from splitting up under the blows of the "ram" or "monkey," the top of every pile has to be protected by a ring or hoop, and a few inches of the timber is wasted in cutting the square head to a circular form to receive the hoop. After driving, the hoop is knocked off and used over again for the next pile, and so on, until it is dropped in the water and lost, or burst in use. Generally the number of hoops provided is one-sixth of the number of piles. The depth of hoop should be about one fifth of the side of pile, and the thickness one-fourth of the depth.

In the case of foundations in a soil liable to squeeze out, or cofferdams where a continuous shield is required against the entrance of water, sheet piling is driven round the site, usually formed of memel planks 4 inches or 6 inches thick, sometimes of half timbers, and more rarely of whole timbers. To keep them in position gauge piles or guide piles are driven at intervals of, say, 10 feet to 15 feet; waling pieces, stringers or horizontal timbers are bolted on these, inside and outside, in not less than two rows, say one double row about half way up or at low water mark, and another double row within a foot or two of the top, notched on the guide piles so as to leave a space between the inside and outside walings equal to the thickness of the sheet piles, and guiding them in their descent so that they present a fairly even surface when finished. Where the ground is bare at low water the lower walings should be at the ground level. Owing to the shape of the sheet piles and the peculiarity of their position, the points are formed differently from those of square piles. There are two varieties, both forms being designed to cause the piles to have a drift towards the one last driven, and insure a close joint. One is shaped like a wood turning chisel, beveled on both sides, and sloping from the horizontal at from 15° to 25°; the other is beveled on both sides, horizontal for about three-fourths of the width, and then cut off diagonally at from 60 to 75° from the horizontal. They weigh from 5 pounds to 10 pounds each, and are usually made of wrought iron plate. Sheeting piles are sometimes birds-mouthed together at 120° to make a tighter joint, and still more complicated joints have been proposed, but if care be taken in using good material a plain square joint will be generally sufficient. Sheet piling, to prevent the spreading of a wet and porous soil under a foundation, is only effective in maintaining the superstructure *in statu quo* so long as the soil remains wet; if drained the surface will, of course, sink, although none of the solid materials can escape. It may not be of much consequence if the whole building goes down uniformly, but unequal drainage will mean unequal settlement and consequent collapse. Piles in the water are sometimes covered at the water level with thin sheet copper, but it is doubtful if this affords any protection either against decay or the attack of worms. To prevent abrasion and thereby progressive destruction by the chafing of barges, oak fender pieces spiked on the exposed faces form the best safeguard. For horizontal fenders or rubbing pieces the American rock elm (*Ulmus racemosa*) or the white elm (*Ulmus Americana*) are most suitable but expensive.

For driving very small piles an apparatus called a ringing engine is used; it consists of a light framework with a pulley at the top and a rope over it, connected at one end to a monkey weighing from 3 to 6 cwt., and at the other end attached to four or six short ropes or tails for pulling by hand power directly applied. One man is allowed to each 40 lb. weight of monkey, and a rapid succession of blows is given with a light fall. Ordinary piles are driven by what is called a pile engine; it is virtually a large hammer, arranged to fall freely and strike a succession of blows upon a given point. It consists of a tall framework, with vertical guides on the face to keep the ram or monkey, as the hammer is called, in a direct line with the head of the pile. The base of the pile engine is placed just above the finished level of the pile head, so that in driving long piles a high framework is required. It is, however, sometimes impossible to get the framework high enough for this, and it is then set 6 or 8 feet above the finished level, and a "punch," "dolly" or "follower," of hard wood, hooped at both ends, is used on the head of the pile when it gets as low as the base of the frame, but the blow is not so effective, and the method should be avoided when possible—it is said to reduce the effect of the blow to one-third. In ordinary cases the monkey is raised by a crab-winch, worked by three or four men, and is connected to the rope or chain for lifting by an intervening slip hook, so that it can be suddenly disconnected and allowed to fall freely when it has reached the required height. In the usual way the monkey can only have a small fall at the commencement of driving, because of the height

of the pile, but the resistance is also very small at starting, and as the pile goes down the fall may be increased. It is then desired to retain a uniform fall, the rope which releases the monkey is made fast to the head of the pile, and the trigger is by this means pulled automatically at a constant height above the pile whatever its position may be.

Where there is much piling to be done, the hoisting of the monkey is usually effected by a small steam engine attached to a vertical boiler and placed close alongside. By throwing the wheels out of gear the chain is rapidly lowered to enable the monkey to be again connected, and much time is saved. In pitching a pile care must be taken that it is started in the right place, as it cannot be shifted, but if the point is not truly in line with the axis of the pile, or gets pushed to one side by meeting an obstruction before it has entered very far, the pile will be drawn over to the side the point leans to. In spite of the greatest care they will sometimes be found slightly out of position, and they have then to be drawn back by chains, twisted like a surgeon's tourniquet, while being bolted to the other timbers. If it be necessary for them to be scarfed, the upper portion can be adjusted by cutting the scarf a little out of line to suit. All piles are not required to be vertical; in building jetties the outside row of piles is often doubled, the outer one being a raking pile for increasing the stability, acting like a buttress.

At the corners of jetties the outer piles are like early English buttresses, raking both ways—say, about 15° from the vertical. Occasionally the structure is braced by diagonal piles, but these are very difficult to drive, and should never be more than 30° from the vertical. When necessity arises, piles may be drawn from the bed of a tidal river by lashing empty barges to them and letting them lift by the tide. Against a river wall or round the foundations of a bridge, piles should be sawn off by a diver as low down as he can get at them, in preference to drawing them, to avoid any risk of scour or undermining of the foundations taking place. On land they may be drawn by lashing a short piece to the top and then prizing it up by another baulk used as a lever, or by a pair of powerful jacks. One of the most interesting questions in connection with pile driving is the proportion between the weight of monkey and the fall to produce a given result. The monkey weighs from 5 to 25 cwt., and is allowed to fall, say, from 6 feet to 20 feet. Upon a superficial consideration it would seem that a monkey of 5 cwt., falling 20 feet, would produce the same result as a monkey of 20 cwt. falling 5 feet, as they both would have 5 foot-tons of energy.

Theoretically, and regarded as a mathematical question only, a heavy ram with a short fall will have the same effect as a light ram with a long fall; but in practice it is found that with too great a fall the effect of the blow is to shiver the timber instead of to force it downwards. A heavy ram, producing the same effect in distance driven as a light one with a greater fall, does less injury to the pile. Dobson says: "In working with a fall from 12 feet to 20 feet, it is common for every tenth pile (say, one pile in ten) to be more or less shaken;" it is as if the top of the pile were driven down while the bottom remained stationary. He gives a table for weight of monkey desirable for various sizes of piles. Weight of monkey in cwts. = 3 (diam. pile inches — 5). This appears to be rather heavy. Hurst's "Tredgold," p. 292, says: "Piles from 10 inches to 14 inches diameter require to be driven with a ram of from 1,000 to 1,700 pounds weight. Sheeting piles require a ram of from 500 to 900 pounds weight." Molesworth's rule for weight of ram (p. 117, 21st edition) is M = wt. pile cwts., W = wt. ram cwts., L = length pile feet, H = height fall feet, s = sectional area pile square inches, then

$$W = M\frac{M\,H}{5\,s\,L} - M.$$

For the first few blows the pile goes down a considerable distance, which gradually becomes less at each blow until the resistance is so great that it will not go any further, or, as it is technically called, "refuses." Were the material of the pile perfectly rigid and inelastic, the impact, however slight, would produce an infinite pressure, but the material is very elastic, and so the fibers of the pile are compressed without the point going any further, and the amount of this compression and the elasticity are strikingly shown in the rebound of the ram when the pile refuses. Generally the driving is stopped when the set, or distance driven by the last blow, does not exceed ½ inch, or the sum of the last three blows 1 inch; but, of course, for this to be any measure of the supporting power the weight of the ram must be in some recognized proportion to the dimensions of the pile. Rankine says: "According to some of the best authorities the test of a pile having been sufficiently driven is that it shall not be driven more than ¼ of an inch by 30 blows of a ram weighing 800 pounds and falling 5 feet at each blow," and there is probably no one who would dispute the fact that if it stood this test, it had been sufficiently driven, some would say over-driven.

The Ultimate Composition of Some Alabama Coals.

By Mr. William B. Phillips, Ph. D.

In seeking to compare the Alabama coals with similar coals from England and the continent of Europe, a serious difficulty was encountered in the absence of analyses showing the actual percentage of carbon, hydrogen, oxygen and nitrogen. Hundreds of proximate analyses, giving the percentage of volatile and combustible matter, and of fixed carbon, were available, but as a rule such analyses are not in use to any great extent outside of the United States. Analyses made by what is known as the "proximate method" are but rarely met with elsewhere than in this country, and on this account it is difficult to institute a just comparison between our coal and the English, German or French coals. As is well known, the proximate method is based on the assumption that, after the hygroscopic moisture is removed at a temperature between 105° and 110° C., the volatile and combustible matter is removed by igniting in a closed crucible for 3½ minutes, over a Bunsen burner, and then for the same time over a blast lamp at a very high heat. What is left in the crucible is termed "fixed carbon." This is then burned off in the air, and the residue is termed "ash." In the proximate analysis, the moisture, volatile and combustible matter and fixed carbon, are added together and subtracted from 100, the difference being termed "ash." The sulphur is not added in, but is expressed separately. In such analyses no account is taken of the hydrogen, or oxygen, or nitrogen, although these ingredients are of great importance in valuing a coal, either for its calorific effect or for its gas making qualities. Proximate analyses are of very little use in valuing coal for gas making, or for the manufacture of ammoniacal salts, as, in the first place, they do not give the content of any of the fixed gases, and in the second place they give no information as to the content of nitrogen. Why they have been preferred in this country, to the practical exclusion of ultimate analyses, would be an interesting question to discuss, but one outside of the scope of the present paper. Suffice it to say that they have been preferred, and that there seems but little hope of changing the custom, much as this is to be desired for many reasons. An ultimate analysis of coal gives the content of carbon, hydrogen, nitrogen and oxygen, the last being usually determined by difference, that is, by adding the percentage of carbon, hydrogen, nitrogen, sulphur, ash and moisture, and subtracting from 100, the difference being termed oxygen. In this way we arrive at two important results, viz., the possibility of valuing the coal for gas making, this value being largely dependent upon the content of hydrogen, and for the manufacture of ammoniacal salts, this depending entirely upon the content of nitrogen. These very important results are lost sight of when we confine ourselves to proximate analyses, for such analyses afford no reliable information on either subject. One might go further, and say that no judgment can be rendered as to the calorific power of coal without an ultimate analysis, for by the proximate method we are told nothing of the nature of the volatile and combustible matter, although this may exceed one-third by weight of the coal under discussion. It is not meant that the calorific power of a coal is to be calculated from the ultimate analysis and the result accepted as true for all cases, but that such an analysis gives us a clue to the energy which the coal is capable of affording when burned under proper conditions. Having these things in view, a diligent search was made for ultimate analyses of the chief Alabama coals, but without success. If they have been made, they are not available to the general public or to the Geological Survey. It was therefore determined to begin a series of analyses which would give both the proximate and the ultimate composition of the principal Alabama coals. It was hoped at one time to have the samples drawn by an officer of the Survey, but as this could not be done now without great inconvenience, the chief companies were requested to send average samples of their coals and coke to the laboratory of the Survey and the metallurgical laboratory of the University. They very kindly complied at once, and the work was begun during the month of February. The analyses of the cokes do not appear in the table, as it was thought best to defer any discussion of them until the fall meeting of the Society, when the coke is to come up for detailed investigation. The samples of coke have, however, been analyzed, and now await the proper occasion for publicity. It is fully realized that the list of analyses given with the paper is not as long as it should be, for there are many coals of equal importance with those treated which could not be reached in time for this paper. During the next 12 months it is hoped to finish all or very nearly all of the prominent coals and cokes, and to give the results to the public through this Society Work is now in progress, especially on the cokes, to include many items of great interest and importance not usually expressed in ordinary analyses. From an inspection of the table it will appear that there is but lit-

tle information to be had concerning the yield of tar and ammoniacal liquor from our coals. Only two companies report any tar, and neither of these can give any figures relative to the ammoniacal liquor, as no attempt is made in this State, as far as I am informed, to save the ammonia. The gas works at Birmingham use Pratt coal, and report a yield of about 13 gallons of tar per ton of coal retorted. The gas works at Mobile report a yield of about 10 gallons of tar per ton of coal. The Alabama Insane Hospital reports no yield of tar, but it can be taken at 13 gallons per ton. The total value of products to be obtained from a ton of coal cannot, therefore, be given for more than three of the coals, viz., the Pratt coal as at Birmingham, the Cahaba coal as at Mobile, and the Asylum seam as at the Hospital. As to the yield of coke per ton of coal, this has been taken at 1,300 lbs., probably the very best that can be done at present. The average yield of coke from the bee hive ovens in the State is not quite as high as 1,300 lbs. per ton of coal, but it is steadily increasing, and in some places is very close to it. The yield of gas per ton of coal can be given for the Pratt coal, the Cahaba coal and the Asylum seam. A yield of 8,000 cubic feet can be and is attained regularly, but our best gas coals will hardly give as much as 10,000 cubic feet. In regard to the yield of sulphate of ammonia, it must be said that this is calculated from the content of nitrogen. As no ammoniacal salts are manufactured from coal in this State, no returns can be given which represent the actual work. This is all the more to be regretted since the completion of these analyses, for they show that some of our coals are very rich in nitrogen, and consequently valuable for the manufacture of the various salts of ammonia. If all the bye-products that could be obtained from a ton of Pratt coal were utilized, they would show a value of not less than $15 per ton of coal, and might show even more. As it is, however, more than $5 worth of sulphate of ammonia is thrown away from each ton of coal used. If we allow that the monthly consumption of coal for gas making in the State is 1,200 tons, an amount somewhat below the true consumption, and exclusive of rolling mills, the annual amount of money represented in sulphate of ammonia is about $60,000. If to this be added the waste from the 5,000 coke ovens, producing about 1,000,000 tons of coke yearly and using about 2,500,000 tons of coal, the figures amaze one. We may take the average value of a ton of coal in sulphate of ammonia at $4, and the average consumption of coal in the ovens at 2,000,000 tons; we thus get a waste of $8,000,000 every year. All of this, of course, cannot be saved, but there can be no doubt of the possibility of saving a great part of it. The coke oven of the future is the oven that will allow of the saving of a great part of the products of combustion, especially the ammoniacal matter. Such an oven may not yield coke as good for blast furnace work as that in the old fashioned bee hive oven, but it will enable us to save some of the enormous waste that now goes on. This waste is not only in the ammonia that escapes into the air (this may in some degree be brought down by rains), but is a waste of calories, which are not again within our reach. Heat allowed to escape into the air is a loss to us. The appliances that are now in use for saving the ammoniacal salts obtained from coal in an oven allowing of the use of the coke may or may not be satisfactory, but the trouble is mainly one of construction, not of principle. The difficulties will sooner or later be overcome, for the advantages to industrial prosperity are too great to allow the matter to remain where it is now. Whatever may be said concerning the adaptability of any coke oven to the profitable utilization of the bye-products, there can be no excuse for allowing the ammoniacal liquor from gas works to flow away. In England alone the yearly production of ammonia sulphate from gas works is more than 100,000 tons, worth more than $6,000,000. In some parts of France the ammoniacal liquor is transported 300 miles by rail before it is worked up into merchantable articles, such as the various salts of ammonia. From 1867 to 1879, omitting these two years, there was made at Besseges, by the Simon-Carves system of coking, 983 tons of sulphate of ammonia, worth nearly $60,000. In the United States, one of the best establishments for the manufacture of sulphate of ammonia is in Washington city. There is at all times a good demand for the article, and it is now worth $4 per 100 lbs. at retail. It is used almost entirely in the manufacture of guano, as a source of ammonia. Thinking it might be of some interest to know how much ammonia was contained in the ammoniacal liquors made at the gas works in the State, although this liquor is not used for the preparation of ammoniacal salts, I secured samples from three separate establishments, viz., the Alabama Insane Hospital at Tuscaloosa, the Birmingham gas works, and the Mobile gas works. On submitting them to analysis, merely for the total amount of ammonia they could be made to yield, the following results were obtained: No. 1,227.—Ammoniacal gas liquor from the Birmingham gas works. Received 16th March, 1891. Obtained from coal analysis No. 1,225. Taken from the hydraulic main. Amount yielded not known. Ammonia in 1,000 gallons, 21.34 lbs., equivalent to sulphate of ammonia, 82.79 lbs., worth $2.64. Specific gravity, 1,005. No. 1,228.—Ammoniacal liquor from the Alabama Insane Hospital. Received 23d March, 1891. Taken from the first tank. Obtained from coal analysis No. 1,209. Amount given per ton of coal retorted not known. Ammonia in 1,000 gallons, 14.93 lbs., equivalent to sulphate of ammonia, 57.92 lbs., worth $1.85. Specific gravity, 1,005. No. 1,236.—Ammoniacal liquor from the Gas Light and Coke Company. Received 10th April, 1891. Obtained from coal analysis No. 1,234. Ammonia in 1,000 gallons, 43 lbs., equivalent to sulphate of ammonia, 166.84 lbs., worth $5.33. Specific gravity, 1,010. Amount yielded not known. These liquors carry by no means as much ammonia as could be dissolved in them. Good gas liquors carry from 1 per cent. to 5 per cent. of ammonia, whereas the richest of these does not carry one-half of 1 per cent. By being used again for washing the gas, any of these liquors could have the content of ammonia increased from two to ten times. In the preparation of ammoniacal salts from such liquors they are concentrated as much as possible; that is, they are saturated with the ammoniacal matters which, by distillation with milk of lime, are made to yield free ammonia. The chemical composition of these liquors varies within quite wide limits; thus, besides ammonia, a gas liquor may contain such salts of ammonia as the hyposulphite, sulphide, carbonate, bicarbonate, sulphate, chloride, sulphocyanate, and benzoate. On distillation, however, with lime, they are decomposed into free ammonia, and this is absorbed in various acids for the manufacture of the various merchantable salts of ammonia. There are coals in this State which yield large amounts of ammonia and make also good coke, and as the success of any utilization-of-bye-product system depends to a great extent upon the chemical nature of the coals to be used, too much consideration cannot be given to the weighty question of ultimate composition and nitrogen content.

The Colorado Automatic Refrigerator System.

[A paper read by Mr. A. McL. Haws, C. E., before the American Society of Civil Engineers.]

An interesting and commercially successful experiment in furnishing a refrigerating medium through a main, in the same manner as steam, gas or water is supplied, has been going on in Denver, Col., for nearly two years. As the enterprise has proven of merit, and is likely to be adopted in nearly all large cities, and, as information on the subject is hard to be obtained, I furnish a brief from a report which I made to the City Counselor of St. Louis, where a similiar company had applied for a franchise to lay mains through the streets.

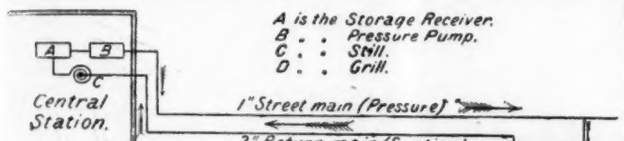
Originally, freezing machines were made for obtaining ice, and providing customers with this product. After that the aim was to furnish the refrigerent to a cold storage warehouse adjacent to the ice machine, and from there the step was easy to supplying any refrigerator along a line of mains. In these machines all liquids which readily evaporate have been experimented with. Since the days of Carre, ammonia has been accepted as the best, because of its affinity for water, and because it is non-explosive, non-inflammable, and by its odor gives immediate warning of any leak or damage. Ammoniacal liquor of the proportion 29 parts pure ammonia to 71 parts water has been determined by many experiments to be the cheapest and most efficient.

The process consists, essentially, in the forcing of this liquor through the main to the point where refrigeration is desired; the sudden increase of space at that point, so it may quickly vaporize, and the absorption by water, to return on a suction line to the central station; the redistillation of the ammonia, and the removal of heat during this process. So that the system is practically automatic and once charged is run continuously, and, barring accidents, without loss.

In March, 1889, the company installed the plant, consisting of one 30 ton ice machine, about 2 miles of mains (with connections for 29 boxes having an air space of 70,000 cubic feet), and the cold storeage warehouse of 50,000 cubic feet capacity. The main is one of the striking features of the plant. It is a 1-inch wrought-iron pipe and is not only capable of caring for the 70,000 cubic feet of air space now in use, but, by the installation of another 30-ton machine, can care for 150,000 cubic feet. The valves in the box connections have a clear opening of $\frac{1}{4}$ of an inch, which will serve for any ordinary cold storage room. Beyond these valves is an inch connection with a grill of 1¼-inch pipes on the ceiling of the room, at the far end of which is a 1¼-inch return pipe to the 3-inch main leading back to the central station.

As the work was entirely in the line of an experiment the cheapest and most convenient materials were used. The conduit is a box about

20-inches square, made of rough planks, and enclosed in 1-inch main, the 3-inch return, box connections, and electric wires for detection of leaks or any disarrangement of the plant. The box is divided into sections, and each section has pipes coming to the surface of the ground at the curbline of the street. By means of these "smelling pipes" a leak or break can be traced up to the section, and then to the very connection which is at fault. An improvement in the conduit, which will be adopted in all future work, is the use of vitrified clay instead of wood. All the specials, as originally put in, were enclosed in larger specials of cast-iron, and the space securely packed with rubber. As the slightest leak of the ammonia turned the packing into "sponge rubber," which exerted an expansive pressure sufficient to burst these cast specials, new designs of wrought-iron were adopted, and all cast-iron fixtures were



CIRCULATING AUTOMATIC REFRIGERATOR SYSTEM

taken off. With the exception of these and a few minor details, no changes have been necessary, and in no case has any customer been cut off for more than 3 hours, and not a single loss or damage has been caused by this company. The electric connections through the conduit, to notify the central station of breaks, are not quite perfected, nor are the electric valves at the boxes for automatically regulating the temperature in each box, a thorough success; due, probably, more to the diminutive size of the opening ($\frac{1}{64}$ of an inch) than to any defect in the principle.

A patrol regulates these things at present, but it is expected soon that the defects will be regulated and the plant will become thoroughly automatic. The main features, however, have been demonstrated to be thoroughly practicable, and no great changes will be made in them.

In May, 1889, the first customers were connected with the mains, and tests were made to show the advantages of the system. Two similar boxes, with similar contents for preservation, the one fitted for ammonia freezing, the other one-third filled with ice, were tested by thermometers placed in various parts. After about eight hours the ice had reduced the temperature from about 62° to 47° F.; after nearly two days to 41° F., and that seemed to be the limit. But by the ammonia process it could be lowered to 40° F., or even lower, in less than fifteen minutes; the air in this case was dry and pure (all moisture collecting at once on the grill overhead in the form of frost) instead of damp and moist; and meats, fish, etc., once frozen, remain so during the whole period of storage. In one case a piece of meat was kept six months and then cooked and eaten, and the difference in flavor between it and fresh meat could not be detected. As soon as business was commenced a problem was met in the regulation of prices. Old ice bills were consulted, and a basis of so much per cubic foot of air space in the box was decided upon. But in some cases this was so manifestly unjust that an arbitrary price was agreed upon. Later researches, based on steam heating calculations, show a surprising agreement with the old ice bills, and what seemed impossible on the former basis, is shown to be very reasonable. So all new contracts are made on the later schedule of exposed surface and openings.

All customers express themselves as very well pleased with the system and its results. The third of their box formerly devoted to ice is a clear gain, as the grill overhead occupies no space that is ever used. The temperature, instead of being a varying quantity, dependent upon the arrival of the iceman, and never below 40° F., can be reduced to any degree above 25° F. in a few minutes, and maintained within 2° F. of the same. Instead of the usual moist, disagreeable air of an ice refrigerator, it is dry, sweet and clean; and the opening of a valve takes the place of the iceman's visit—with all uncomfortable circumstances. So enthusiastic over it are some customers that I cannot refrain from quoting two extracts. One consumer says: "The Colorado Automatic Refrigerating Company's system is absolutely perfect, and is something that a butcher needs to use for only one week to make him feel that he is rescued from one of the greatest evils of the butcher's business, namely, the price, trouble, labor, and dirt, attendant upon handling natural ice;" and another writes "To-day, if ice was given me gratis, and even placed in my box free of charge, I would not use it, and exchange my present method of obtaining cold air." These go to show the way the system is regarded by all who know it thoroughly, and that it has passed through the experimental stage to a well settled business enterprise.

Electric Gas Lighting Apparatus.

Hardware says that the frictional machine for gas lighting makes use of the generation of static electricity which takes place when one insulating material is rubbed briskly with another. We are all familiar with the experiment of rubbing a glass rod or a stick of sealing wax with a silk handkerchief, and we know when this is done that the glass or sealing wax becomes charged or electrified. The frictional electrical machine is merely a development of this experiment, and the frictional machine for electric gas lighting is merely a form of the frictional electrical machine arranged and adapted for a particular use. If instead of a rod we take a disc of glass or some similar material and provide it with a spindle and crank with which to turn it, and place a pair of cushions bearing against the surface of the plate, then by turning the crank swiftly we can produce a charge of electricity on the surfaces of the glass or hard rubber disc.

This charge can be drawn off by means of a couple of metal collectors having each a row of fine points which almost touch the surfaces of the disc. If these collectors are connected to a Leyden jar or condenser, the electricity generated by revolving the disc will accumulate in the Leyden jar, and when this is discharged by connecting its two coatings together a spark will be produced.

A condenser is simply a compact form of Leyden jar. It has plates of metal separated by plates of insulating material. However many plates it may contain, all the even numbers are connected together at one end, and all the odd numbers at the other, thus forming practically two large plates. These plates being connected to the source of electricity, a charge will accumulate on them, and this charge can be suddenly dissipated by connecting the plates together for a moment by a piece of wire. If the condenser has been charged to a high tension a long spark will be produced when the piece of wire connected to one terminal is brought near to the other terminal.

The principle of the frictional gas lighting machine, then, is clear; its actual construction is very simple. A wheel or disc of hard rubber provided with a shaft and crank is mounted on bearings in an insulated case; pressing closely against the sides of the disc are two small cushions which are treated with a special amalgam that intensifies the exciting action of the cushions and prevents them from wearing out rapidly. A pair of metal combs or collectors placed on opposite sides of the disc serve to collect the electricity which is generated when the wheel is revolved, and conduct it to the condenser with which they are metallically connected. The disc, cushions, collectors and condenser are inclosed in an air-tight hard rubber case through which only the shaft, provided with its crank, projects. Above the case are the binding posts for connecting wires.

To operate the machine the crank is turned, clock-wise, for a certain number of turns required to produce a spark capable of lighting a certain number of burners. The machines are generally made in two sizes, 8-in. disc and 12-in. disc. The smaller size will light 50 burners when in prime condition, and the circuits are properly run and insulated; it is considered better and more economical not to overload the machine, but to use about 35 burners on a circuit. The larger machine has a capacity for lighting 150 burners where the insulation is perfect, but the safer plan is to limit the number of burners in one circuit to from 50 to 75.

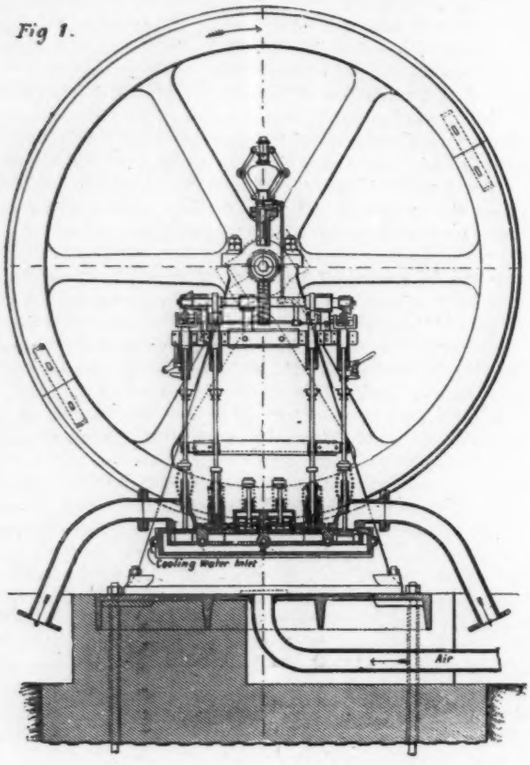
The machine and the switch governing the circuits should, of course, be placed near the stop cocks by which the gas is turned on. Care should be taken in putting the switch and frictional machine in place to see that they are thoroughly insulated. They should never be attached directly to a wall, be it ever so dry, but should be mounted on a base of dry wood which is first secured to the wall and well varnished. As one terminal of the machine is connected to ground any defect in insulation will cause a loss of energy, weakening the current and thereby limiting its spark producing powers.

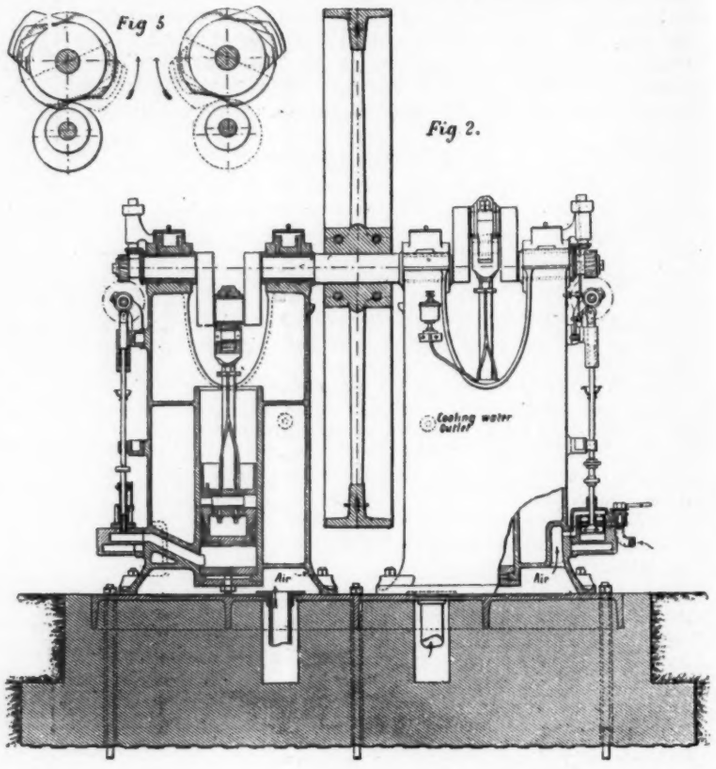
For installations of any size, where a number of circuits have to be supplied, it is better to use the larger size of machine. The 8-inch machine will not stand very hard work as the cushions are very small; with much use the amalgam wears away, and this has to be renewed, causing expense and loss of time. The larger machine, therefore, in the long run, will be found to be by far the more economical of the two.

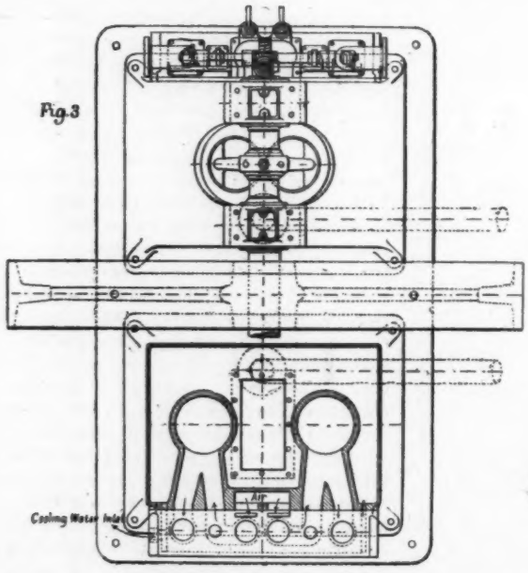
THE capital stock of the Beverly (Mass.) Gas Light Company has been increased in the sum of $25,000. Total, $85,000.

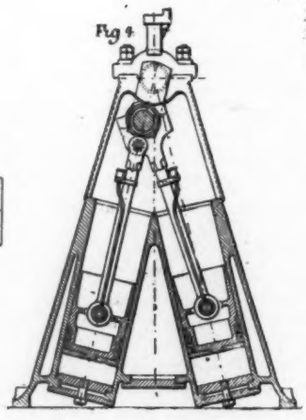
Thirty-Horse Four-Cylinder Gas Engine, Adam Type.

The illustration shows a 30-horse power gas engine, shown at the Frankfort Electrical Exhibition, by the Maschinenbau-Gesellschaft Munchen, of Munich. This engine, which is the invention of Mr. G. Adam, of Munich, is adapted for working either with gas or the vapors of hydrocarbon; Fig. 1 is an end view of the engine, Fig. 2 is partly a side elevation and partly a section through one of the cylinders; Fig. 3 is a plan; Fig. 4 is a section through one pair of cylinders; and Fig. 5 shows the cams actuating the valves. As will be seen from the engravings, the engine is single-acting, with four cylinders 9.84 in. in diameter and 15 in. stroke; the indicated power of the engine is 38-horse power, with a speed of 160 revolutions. Each pair of cylinders may be regarded as constituting a motor, so that the engine consists of a pair of such motors mounted on the same bed-plate, and supporting the bearing of a shaft with cranks placed at 180 deg., and a fly-wheel in the middle between the motors. The valves through which the engine is actuated are placed at the foot of each pair of cylinders as shown in Figs. 1, 2 and 3; the air is admitted through the pipes passing into the chamber in the bedplates, and the exhaust is taken through the pipes shown in Fig. 1. A special feature of the design is the mixing valve shown on the right hand side of Fig. 2. This valve is automatic, and is held in its place by a light spring; air is admitted through the passage in the bedplate, and passes through openings made in the top of the valve seating. The gas is admitted through the tap shown, and flows through small passages in the valve chamber to the coned valve; as this valve is forced from its seat at each stroke of the piston the air is drawn past it with the gas, and the two are mixed in the desired proportions, and it is claimed very thoroughly. One such mixing valve is required for each cylinder, as well as one igniting valve; these, with the exhaust valves, are placed together, as already stated, at the foot of each cylinder. The igniting valve, Fig. 2, is constructed as follows:









The igniting valve shown on the left hand side of Fig. 2, as well as on Fig. 1, is of cast iron; it is hollow and slides vertically in a cast iron casing. Below the igniting valve is arranged the device required for regulating or feeding of the igniting flame and for the production of an igniting flame from compressed gas. In the hollow valve slides a core, moved by the regulating rod and cam driven from the main shaft. This core when descending first closes the hollow valve, and then depresses it, but the valve is pressed upward on its seat by a spring. The action is as follows: From the casing, combustible gas, when the mixture is compressed, flows through a small hole to the recess and into the hollow space of the valve where the gas is ignited by a continuously burning flame. The flame in the hollow space is fed until the core closes it, and at once presses down the valve proper until the passages come in contact with the compressed gas in the chamber, which is ignited, and the whole charge in the cylinder thus exploded. The valve with the core remains pressed down or closed during the period of combustion as well as during the exhaust and suction period.

A positive motion is given to the ignition and exhaust valves by means of the regulating gear indicated in Figs. 1 and 2. On each end of the shaft is a pinion gearing into a toothed wheel on the middle of a countershaft carried in bearings attached to the end frames of the engine. Upon each of these shafts is a series of cams shown to a large scale in Fig. 5, so arranged as to press on the roller at the end of each of the spindles rising from the valves, and give it the desired travel; the springs above referred to bring the valves and spindles back into their proper position.

The engine shown at Frankfort is employed to drive a dynamo exhibited by the Thomson-Houston International Electric Company, of Hamburg. It appears that a very large number of these engines are in use in Germany, with 1, 2 and 4 cylinders, and ranging from one half to 150-horse power.

The Miners' Law of Alabama.

The following is the text of the bill to create in Alabama the office of inspector of mines, and to prescribe the duties of said office.

SEC. 1. Be it enacted by the General Assembly of Alabama, that the office of inspector of mines is hereby created. The said mine inspector shall be appointed by the Governor, within ninety days after the passage of this act, and he shall hold office for two years, or until his successor is appointed and qualified. Before assuming the duties of said office the inspector shall take and subscribe an oath to perform, to the best of his ability, and without fear or favor, the duties of said office, and shall give a bond of $2,000, to be approved by the Governor, to cover any default in said office.

SEC. 2. Be it further enacted, That it shall be the duty of said inspector to visit officially every underground coal, iron, and other mine in the State where twenty or more miners are employed, at least once in every three months, and examine in person, and in detail, the methods and manner of working said mines, and if, in his opinion, any changes are required, he shall notify in writing the operator or owner of said mine what changes are required to be made in the manner of working, or in the machinery and fixtures used in working said mine, and if said changes are not made in a reasonable time, he shall, after conferring with the board, as constituted in section 7 of this act, refer the matter to the probate judge of the county, from whose decision, after hearing the said matter, either party may appeal within sixty days to the Circuit or Supreme Court, otherwise it shall be final and binding on the said operator or mine owner; and any operator or mine owner who refuses to carry out the said final order after a reasonable time, shall be guilty of a misdemeanor, and may be fined not more than $1,000, by any court of record in the county.

SEC. 3. Be it further enacted, That whenever required by the State or inspector of mines of any operator or mine owner, two openings shall be made, one for an escape way if practicable, in any mine operated or owned by them. Reasonable time, however, shall be given to said operator or owner to prepare the second opening, in no case exceeding two years from the time such order or requisition is made.

SEC. 4. Be it further enacted, That every mine operator or owner of any mine in this State, shall, within twelve months after the passage of this act make and keep in their office or principal place of business, a map or plan of their mine workings, both old and new, and file a copy of the same in the office of the probate judge of the county where said mine is located, to be preserved by said probate judge as other records are, and each twelve months thereafter a copy of all changes or progress in said workings shall also be made and filed, or marked on the maps already filed in the office of the probate judge as aforesaid. The said maps shall be made on a uniform scale not less than 400 feet to the inch. The approaches to any old workings shall be done and made in the manner prescribed by the inspector of mines when pools of water are suspected.

SEC. 5. Be it further enacted, That the inspector of mines shall give directions to the mine operators and owners as to the method or manner of working gaseous mines, and the manner of working or propping the roof in any or all mines, and shall examine the machinery and appliances used in working the same, and give directions as to the examination of the same. All of such directions shall be given in writing, subject, however, to reference as hereinbefore provided, and to the penalties for failure to comply as provided in section 2 of this act. The expense of all such appeals shall be paid by the party asking for such reference.

SEC. 6. Be it further enacted, That the salary of the said inspector of mines shall be $1,500 per annum, to be paid as other State officers are, with an allowance not exceeding $400 per annum for actual traveling and office expenses, to be paid out of the treasury. The said inspector shall keep his office in Birmingham, Jefferson county.

SEC. 7. Be it further enacted, That the said inspector of mines shall, together with two mining engineers, to be appointed by the Governor for two years, form a Board of examiners to examine and give certificates of fitness and service to mine bosses, and after 12 months from the passage of this act no person other than those now acting as mine bosses shall be employed as such unless they have a certificate of fitness or service given by the board created as above. For each person examined the board shall exact a fee of $3, to be paid before the examination is begun. The said amounts to be received by the inspector of mines, who shall be *ex officio* chairman of said board without extra pay. The mining engineers on the board shall be paid by the inspector $4 per day out of the examination fund, and the remainder, if any, shall be turned into the State treasury. The said board shall meet once in three months at the office of the inspector of mines in Birmingham, and can hold two days only at each meeting, except when called together by the inspector.

SEC. 8. Be it further enacted, That mines where not more than 20 miners are employed shall not be subject to the provisions of this act. Nor shall the examination or requirements of the mine inspectors relate to any matter except where the health and safety of mine employees are concerned.

SEC. 9. Be it further enacted, That the Governor may discharge the mine inspector at any time for unfairness, unfitness, incompetency and malfeasance in his office, and appoint his successor for the unexpired term.

SEC. 10. Be it further enacted, That the inspector shall first refer any matter at issue between him and the mine owners or operators to the board as constituted in Sec. 7 of this act, for their action and decision, before referring the same to the courts.

The Electric Light in Paris.

A contemporary notes that the manner in which Paris is now proceeding to introduce electricity in every portion of the municipal area is of the utmost importance to all other cities that have to do with similar problems. There has been no undue haste. On the contrary, the subject has been treated in a patient, scientific, systematic way.

To begin with, the municipality has spent 2,000,000 francs or more in making a central electrical installation of its own in the basement of "Les Halles Centrales," the great central market of Paris. This plant is conveniently situated for the illumination of a number of public buildings and establishments, and it can be enlarged indefinitely. But it has never been intended to use this or any other municipal installation for the general work of lighting the city. It is for experimental purposes, and also for the purpose of acting as a regulator of charges. It enables the municipality to command the situation, and gives it a corps of men who understand the practical details of an electrical establishment. For the purpose of general illumination the city has been divided into seven "secteurs electriques." Paris is approximately a circle; and the secteurs are segments, the dividing lines of which radiate from the vicinity of the Halles as a center and extend to the circumference. Each of these secteurs has been granted exclusively for a short term of years to a responsible electric company. The Edison Company has been accorded one, the great Paris contractor, Victor Popp (using the Thomson-Houston system), has two, and the others are conceded respectively to the Messrs. Rothchild, Societe Alsacienne, the Ferranti Company of London, and Naze & Co. (representing the Westinghouse system). Several of the secteurs were granted in the latter part of 1890, completing the distribution.

As one of the conditions, it has been required that the companies pro-

ceed at once to make their installations, and that within two years their districts shall be completely served with main cables. Thus, before the end of 1892, such provision will have been made that, if desired, every street in Paris, as well as every house, can be illumined with electricity. It is required that the companies shall supply street lighting upon terms that are as favorable as possible, at cost or even less, and a maximum rate of charge to private users is prescribed. Each company has been required to give a guarantee fund of several hundred thousand francs to insure the fulfillment of all the conditions imposed in the concession. No payment has been required for the charters, the terms being short, and permanent arrangements being deferred until use can be made of the results of 5 or 10 years' experience. Meanwhile the city has its own central plant, and it is not debarred from laying its cables into any or all of the secteurs, with a view to regulating prices by competition. Thus Paris is on the point of being more completely supplied with electric lighting facilities than any other large city in the world.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, July 10, 1891.

Gas Affairs at Manchester.—New Projects.—The Capital of Gas Undertakings.

Those who claim that gas supply ought to be in the hands of municipal authorities, and not left to that private enterprise which is sufficient to meet the demands for nearly every other commodity, would do well to direct their attention to Manchester. This important city has enjoyed every possible advantage in regard to the establishment of its gas works. These were commenced a long while ago, about 60 years, I believe, by the Corporation themselves, and the capital invested is no more than that actually necessary to pay for the cost of land, structural value of plant, etc. Manchester is, therefore, in a position, as compared with other cities where the works were started by a private company, and subsequently bought up by the local authorities as a going concern, of being burdened with only about one-half the usual amount of capital as compared with the quantity of gas sold, seeing that several instances might be quoted showing that double the actual expended capital, or more, has been paid for gas works in going order, the excess being considered to represent the "good will" of the business, and the loss of future profits to the shareholders. Under these advantageous circumstances, leaving out of consideration those which some would credit to the municipal management, which is supposed to afford a great saving in establishment expenses, gas should be both good and cheap at Manchester. It should, in fact, be the gas consumer's paradise, if it were possible for such to exist in any place where gas meters are used. But yet there are continual complaints amongst the consumers, both as to quality and price. I do not propose to enter into these at present. The object in view is to illustrate the remarkable position taken up by the gas committee in reply to recent agitation on the subject of price. The committee say that already the demand has become excessively large, so much as to tax the capacity of the works to the fullest possible extent. This is ascribed to recent reductions of price in some old townships, and to the extended use of gas for purposes other than lighting. It is urged that at present prices the consumption continues to increase, and that, under the stimulus of a general reduction in prices, it would get beyond their powers of supply. Certain extensions are in progress, but only a portion of these will be ready for use in the next heavy season. So it appears that the unfortunate gas consumer must pay more for his gas for another year or so, simply to render a regular supply more certain. In any case this appears somewhat doubtful at the time of maximum production, as the working under such conditions must approximate more nearly than is either desirable or pleasant to a "hand-to-mouth" state of affairs, in which an accident that would be otherwise unnoticed would be sufficient to cause great inconvenience. The committee have failed to keep pace with the demands of their undertaking, and the customers must wait while the lost ground is recovered.

There is something amusing about the position of being inconvenienced by a moderate increase in business, such as could be foreseen by any one of ordinary capacity. In a case of a very large advance suddenly sprung forward there is some excuse, but as it is there is a flavor of weakness and incapacity, or else of too great zeal in the direction of economy, that would be strongly censured if Manchester was supplied by a company. In such case, assuming the usual legal obligations to have been incurred, the company would be subject to heavy penalties if the supply fell short. Perhaps this is one reason why, throughout the recent severe winter, when the consumption beat the record by 20 or 30 per cent., and that for weeks together, the complaints of short supply were so few and far between. Gas companies are bound to keep up a certain pressure in all parts of their district, and therefore they are always careful to have a reserve of producing and purifying capacity, which is usually put at 20 to 25 per cent. That the wisdom of such a provision was appreciated is shown by the eagerness with which orders for extensions were placed early in the year, so as to be available for next season, and to avoid the position now occupied by the Manchester Gas Committee, who look with apprehension at any cause of probable increase in the demand for gas. The management of gas companies is always more or less severely criticised, and it is easy to imagine what would follow the issue of such an excuse for not reducing the price of gas, from the office of a gas company. It is extremely unlikely, however, that this will ever occur.

Gas engineers who desire to keep in the foremost rank, and, therefore, take care to be acquainted with every new plan that is brought forward, are now having a busy time of it. So many different schemes now await their attention that it can scarcely be said that gas making is in danger of settling down into one rut. Remarks to this effect were frequent a few years ago, and there was then more reason for them. A perusal of the proceedings at the meeting of the Institution of Gas Engineers, in London, in May, and at the meeting of the Gas Institute, at Carlisle last month, cannot fail to strike one with a sense of the change that is gradually coming over gas managers' meetings, by reason of the number of new subjects that form matter for papers. Such topics as "the reduction of unaccounted-for gas," and "how to keep up the heats in the retorts," are crowded out by methods of carbureting gas, inclined retorts, water and oil gas systems, retort house and coal conveying machinery, gasholders without guide-framing, etc. All these topics have been duly discussed, and it appears certain that gas can be maintained at a regular standard of quality by carburation at the outlet of the holder. The method followed is to by-pass a greater or less quantity from the distributing main, pass it through carbureting apparatus, and thus raise its quality to a high standard, say 25 or 30 candles, and then return it to mix with the bulk. The proportion of the total gas that is so treated is varied as may be necessary. A great deal of activity obtains in the matter of inclined retorts, but although good results have been recorded it can scarcely be claimed that the all-round superiority of the inclined, as compared with the ordinary horizontal system, has been indisputably demonstrated. It must be remembered that the inclined retort really means a new way of getting the coal in, and also of getting the coke away from the retort. It also means a new form of furnace. So that the advantages of this system cannot be arrived at except by a costly process of practical experiment. This is now being undertaken, and there is reason to hope that success will ultimately be obtained.

The Gas Light and Coke Company, of London, have gone in for water gas in earnest, putting up plants that are capable of producing 1,000,000 cubic feet per diem. This step, which is no doubt the outcome of Mr. Trewby's recent visit to the United States, has attracted attention, and the results obtained by it will be watched with great interest. Some attention has been directed to the use of oil injected into the retorts during the latter part of an ordinary coal gas charge, and also used in other ways. The work done in this direction appears to have been more in the way of experiment than in the introduction of works or plant of a permanent nature. Oxygenated oil gas has been brought forward as an enricher, but I have not heard that it has been adopted anywhere for practical working. The high specific gravity of this gas would tell against its adoption to any extent beyond a very moderate percentage. Perhaps the most marked progress in the way of novelty has been the introduction of coal conveying machinery, by means of which the coal can be carried from the barge or lighter directly to the retorts without the intervention of manual labor. Drawing and charging machinery has also progressed rapidly during the past year or so, and there is scarcely any large works where it is not being tried, while at the same time it is extending into the smaller class of works. Gasholders without outer guide framing, on the Gadd, Pease and other systems, have become an established fact, several having been erected and put into regular use, so the advantage or otherwise of these innovations will be no longer a matter of argument and opinion.

I was much interested in reading the remarks made by Mr. Egner, in his capacity of President of the Western Gas Association, on the capital of gas undertakings and the importance of avoiding any merely nominal increase in its value. They represent the general view in England, and one reason why gas is sold cheaply here is that anything in the way of "watering" the stock is uncommon. As a general rule the capital stands at the sum actually paid in, the whole of which has been expended for *bona fide* capital purposes, such as the purchase of lands, erection

of plant, laying mains, etc. At the last meeting of the Plymouth Gas Company, which enjoys the honor of supplying the cheapest gas in England, the Chairman told the shareholders that the sole reason why the Company were able to supply gas so cheaply was that their capital stood at the low rate of $8.40 per ton of coal carbonized, whilst that of other companies is considered moderate if below $20, and often ranged as high as $40 per ton of coal. This simply meant that 8 cents per 1,000 cubic feet was sufficient to pay full dividends, whereas other companies required 20 to 30 cents. Taking the working expenses as the same, the difference between 8 and 20 or 30 cents went to the consumers, and the Plymouth Gas Company were, therefore, able to sell at 12 to 20 cents cheaper. This is the case in fact, the Plymouth price being 42 cents, and other companies of similar size ranging from 50 to 60 cents.

The Plymouth Gas Company enjoy particularly favorable circumstances in several respects. They are well situated for getting in coal and for disposing of residuals, and I am told that one cause conducive to the low capital is the fact that the present Company was able to acquire the undertaking as a going concern, on very low terms. In a seaside residential place, the fluctuations between summer and winter consumption are not so marked as those in inland factory towns, and this part, no doubt, contributes to the low capital at Plymouth. The gas works must be equal to the maximum consumption if the greater part of them has to lay idle for 9 months in the year. At many fashionable watering places the consumption is fairly equable all the year round, the influx of visitors during the summer causing an increased demand, while the town is dull and quiet in winter.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

At the annual meeting of the Duluth (Minn.) Gas and Water Company the following officers were elected: President, Q. M. Cary; Vice-President, J. H. Upham; Treasurer, R. B. C. Bement; Secretary, George C. Squires.

Mr. Frederic Egner, Chief Engineer of the Standard Gas Light Company of this city, can be addressed either at his office, foot of East 115th street, or at his home, No. 827 East 138th street.

The United Gas Improvement Company is under contract to erect three sets of the improved Lowe apparatus at the works of the Equity Gas Company, Brooklyn, N. Y. The total capacity of the installation is put at 1,500,000 cubic feet per diem.

Messrs. James R. Floyd & Sons, of New York, will put in the purifiers at the Equity works. The dimensions of the boxes are 20 ft. by 24 ft. by 6 ft. in depth.

An esteemed correspondent at Columbus, Ga., forwards the following, which goes to show that the executive management of the Gas Light Company are doing better than ever—and that is decidedly positive praise:

Columbus, Ga., July 17, 1891.

To the Editor American Gas Light Journal: At the annual meeting of the Gas Light Company of Columbus, held on the 16th inst., the following officers were elected: President, T. E. Blanchard; Secretary and Treasurer, T. D. Huff; Supt., E. H. Jenkins; Directors, W. L. Clark, D. F. Willcox, D. P. Dozier, J. B. Holst, and T. E. Blanchard. The report of Superintendent Jenkins shows an increase in sale of gas of 14.2 per cent. over last year, and an increase of 10.2 per cent. in the number of consumers. A year ago the price of gas for fuel purposes was reduced to $1.25, net, per 1,000 cubic feet, and the increase in sales for that purpose amounted to 163 per cent. over last year. The usual semi-annual dividend was paid.

"Colonel Jeremiah W. Coveney, Governor Russell's private secretary, was, on the 16th inst., named to succeed the Hon. A. B. Coffin on the Massachusetts State Board of Gas and Electric Light Commissioners, Mr. Coffin having determined not to accept a reappointment. Col. Coveney served in the State Legislature during the years 1874, 1875, 1876 and 1884, and for four years acted as Surveyor of the port of Boston during the Presidency of Mr. Cleveland. In the war of the rebellion he was Colonel of the 28th Massachusetts Volunteers, and is a very popular man.—Observer."

At a meeting of the Directors of the Gloucester (Mass.) Gas Light Company, held about mid-July, it was resolved that a discount of 20 per cent. from the gross rate ($2 per 1,000) be allowed to all consumers whose bills are paid on or before the 15th of the month. The discount is to rule from the 1st of the month, and is evidently traceable to the arguments of Superintendent Coffin, who always has been a consistent believer in the good policy of selling gas cheaply.

We understand that the proprietors of the Dover (Del.) Gas Company are about to make extensive plant improvements. In fact, if our information is correctly based, the works are to be virtually rebuilt.

We had a call the other day from Mr. C. H. Raynor, of Adrian, Mich., who has not presented himself in New York for eight years, although a New Yorker born and bred. He says that the Adrian Company is "holding its own and a trifle more," which is not to be wondered at when the statement is made that coke sells readily there at 10 cents per bushel (prepared), and that tar is worth $4.50 per barrel in the same locality.

The following is the text of the message forwarded to the City Council by Mayor Washburne, of Chicago, vetoing the ordinance under which the Economic Fuel Gas Company was permitted to manufacture and distribute illuminating gas as well as fuel gas—the veto, as our readers are aware, was subsequently overridden by the Council by a vote of 54 to 10:

I am constrained to return without my approval the ordinance passed at your meeting of July 6th, amending an ordinance passed December 22d, 1890, granting to the Economic Fuel Gas Company the right to construct and operate gas works and gas pipes in the streets and alleys of the city. In doing so I beg to say that it is only after a careful consideration on my part of the provisions of the ordinance and the circumstances and conditions that I think are controlling ones that I thus interpose my veto upon the action of your honorable body. This ordinance would permit "a line or lines of gas pipes and all necessary feeders and service pipes in connection therewith for the distribution of illuminating gas and natural and manufactured fuel gas." This ordinance, if it should go into effect, would give this Company the additional right to tear up all the streets of the city, not only for its pipes for the supply of natural and fuel gas and manufactured fuel gas, but also again for its pipes for illuminating gas. It would permit, if availed of for supplying manufactured gas for illuminating purposes, manufactured gas for fuel purposes. The natural gas, I understand, would require the placing in the street of one set, and would permit two different sets of mains and pipes for manufactured gas and another different set of pipes for natural gas. It is a well known fact that it has not been safe or practicable to use for natural gas such mains and pipes as are used for manufactured gas. This ordinance would permit at least two more great systems of pipes in the streets, and the tearing up of the streets therefor at different times. Besides these mains and pipes there would be, at intervals of 20 or 25 feet, the building connections for pipes to the buildings to be supplied and the excavations therefor. This ordinance would permit a double tearing up for pipes and connections to be done separately for each set of supply pipes. The necessary dimensions and frequency of these excavations in the streets would be substantially such that the entire street would have to be dug up twice, and during such work would be entirely closed to travel. This would be more true in the central portions of the city, where the streets are now congested with travel and their capacity is not sufficient to accommodate the demands of public travel. The conditions hedging in and limiting the street space through the central business district of the city are such that with the rapid growth of business the capacity of every street is becoming so taxed as to call for serious considerations of measures for obtaining relief. This problem is more serious on account of the approaching World's Fair. People are already coming here in great numbers, and this flow of population will rapidly increase and our streets become more crowded until and after 1893. In this condition of affairs nothing but the most urgent public necessity would justify such additional closing of streets or blocks to public travel as this ordinance would permit. To give this private or even quasi-public corporation any further right at this time than that already given, to occupy any of these streets and exclude the public travel therefrom could not under present conditions be justified. The primary purpoes of the streets is for public travel. The necessities of the public must be the first consideration in regulating their use. The permission to another corporation like a gas company or railroad company to use the streets can only be justified at any time by the greater benefit resulting. Under the present condition and circumstances the supreme public necessity is that the streets be kept in condition for travel and devoted to such public use with as little interruption as possible, at least until 1894. I do not lose sight of the fact that this Company has already an ordinance, passed in December last, granting the right to lay pipes in the streets of the city for the distribution of fuel gas. The present ordinance, however, which gives them the further

right to lay another set of pipes in the streets for the distribution of illuminating gas would permit these different sets of pipes to be laid at different times. The Company is not required to lay the pipes for fuel and those for illuminating gas at the same time. It may now be ready to furnish fuel gas and tear up a street for that purpose this year, and in a couple of years hence again tear up the same street for the purpose of laying their illuminating gas pipes, thus causing double damage to the pavement and double interference with travel. And besides this, while, by the ordinance, the Company is required to restore the street after its work is done, it is settled by all the experience of the past that a pavement thus in part torn up, and replaced over such excavations, however carefully the work may be done, is seriously damaged. This leads one to say that if any additional rights to tear up the streets for the purpose of laying gas pipes therein were to be given, I think a provision in the ordinance requiring the payment of, or securing to the city a specified amount to cover this damage before it is permitted to be done would be only equitable and just. This should be in the nature of an immediate payment to the city, which might ultimately be called a percentage or rebate. If this Company seeks additional rights you have the power to impose, as a condition of granting these rights, fair provisions for the payment of damages to the city caused by the pipes, authorized by the original as well as by the amended ordinance. There is another consideration which I deem a serious one. The streets, and especially those in the central portion of the city, are already filled with pipes, sewers and conduits. There is little room for more. It would be doubtful if room could be found in many streets for the double or triple sets of pipes authorized by this amended ordinance, and I believe that the city should be very careful in granting further privileges of this character, in view of the present limited space now left under our pavements, which is likely to become necessary to the city in the future and which certainly has a large monetary value. I think the change and extention of time for laying the first 12 miles of pipe which is given by this amended ordinance is open to serious objection; that extension gives the company the year 1893 during which the tearing up of the streets would go on. I cannot give this provision of the ordinance my approval. During no period in the history of the city has the importance of having our streets in good condition for travel and of sightly appearance been so great as it will be during the year 1893, and in a scarcely less degree during the years 1891 and 1892. Another, and one of the most serious objections to this ordinance is that it does not, in my opinion, provide adequate compensation to the city and the public for the privilege granted. I think such compensation should be an adequate return for the benefits of value given. Whenever the city acquires private property for the public use of a street it is compelled to pay full market value thereof. When the city is asked to grant valuable rights or privileges therein, why should it not also receive the value thereof? I do not think this ordinance provides for any return to the city to be compared with the value of the privileges granted. While it provides for the payment to the city of 3 per cent. of the receipts of the company from the sale of illuminating gas, and 5 per cent. of the receipts from the sale of fuel gas, there is no guaranty of any specified minimum amount that the city shall receive. It is clear to me that the city would not receive for some time any substantial return from this provision which could be looked upon as some compensation for the privileges granted in tearing up the streets and inconveniencing the public. It should be borne in mind that in the adjustments with the existing gas companies, in which a percentage on illuminating gas was demanded and conceded, a guaranty was given that the percentage which the city should receive would be at least $150,000 a year, from January 1, 1891. These companies had their mains and pipes already in the streets, and had existing franchises, and at the same time the city was under the then present necessity of getting its supply of gas from day to day from them, and negotiating the price thereof. The situation with new companies now seeking franchises is entirely different. The city authorities can, in granting them franchises, dictate the terms. Those terms should be more favorable to the city than could be looked for from the old companies which are not seeking new franchises. A new company could now build its works and lay its pipes through the city at much less cost than the older companies were subjected to. I think that if a franchise were now to be granted, the percentage to be paid to the city upon the receipts from manufactured illuminating gas should be at least 3½ per cent., and 5 per cent. on receipts from fuel gas, natural or manufactured, with the guaranty that the same should amount to not less than $150,000 a year, and that the payment of such minimum amount should commence at some specified time, say Jan. 1, 1892. In other words, that before any franchise should be granted to a new company for this purpose, the city should have a guaranty of at least $150,000 a year, whether said company be in operation or not, and that such guaranty should commence not later than Jan. 1, 1892. I do not agree with those favoring this amended ordinance that the granting of a franchise to a new company will necessarily reduce the price of gas to the city or to the consumer. My reasons for this opinion are based upon the history of gas companies in foreign cities and other cities in this country. For the reasons herein stated, I cannot approve the ordinance as submitted for my consideration, and herewith return it with my veto."

Mr. John Q. Brown, Gas and Water Inspector to the city of San Francisco, reports to the Supervisors that during the fiscal year, closed June 30, the gas for 5,389 street lights, with the necessary repairs, etc., cost $208,787, an average of about $17,000 per month. The supply for public buildings cost about $5,900. The street lamp rate is 12 cents per lantern per night. On account of public electric lighting the disbursement was $50,464, or about $4,100 per month. Of the amounts paid out on account of gas lighting the San Francisco Gas Light Company received $214,712 and the Pacific Gas Improvement Company obtained $19,825. The Inspector says that the city order requiring notices relative to the use of gas burners has not been well complied with by hotel and lodging house keepers. Out of 297 in the city only 64 had filed reports up to July 1st. He says that in enforcing this order he shall shortly place the list of those who have not complied with it in the hands of the authorities, who, under the ordinance, are directed to punish those who neglect to carry out its provisions.

H. W. Calvin, Clerk of the city of Youngstown, O., says that sealed proposals will be received by the City Commissioners of Youngstown until noon of August 10th for lighting the streets and public buildings. The contract is to take effect on the 26th of November next.

Miss Andrews has arranged with the Yonkers (N. Y.) Gas Company to give a series of lectures on cooking by gas.

Charles Lenz, Cashier of the Williamsburgh (N. Y.) Gas Light Company, committed suicide, at his home, 817 Park avenue, Brooklyn, N. Y., on the evening of the 16th inst.

A correspondent forwards the following, which goes to show that Mr. Stiness is as firm as ever in his belief respecting the sound business policy of operating gas and electric lighting plants in conjunction: "Down by the Division street bridge, in Pawtucket, R. I., ground has been broken for a new electric lighting station for the Pawtucket Gas Company. The present business of the Gas Company's lighting plant calls for nearly 500-horse power, and Messrs. Remington & Henthorn, of the city, have planned a station in which about 2,000-horse power can be utilized before enlargement is necessary, and which can then be extended indefinitely. There are to be three main buildings of brick, connected by doorways. The dynamo house will be 150 by 60 feet, inside, and will follow somewhat the plan of the Naragansett station at the foot of South street. The floor of the dynamo room will be 13 feet above the cellar floor, the height from the dynamo floor to the girders to be 19 feet. This building will be ornamented with brick pilasters, and the window frames are 10 feet in height. A side door allows the machinery to be taken in upon the dynamo floor, and an overhead traveling crane will command every inch of floor space. The engine house is to be 78 feet by 58 feet, and the boiler house will be 78 feet by 60 feet. At the rear of the boiler house will be a brick chimney, 16 feet 8 inches square at the base, with a circular flue 7 feet 6 inches in diameter and 150 feet high. The buildings will all stand on made ground, and while it was from the first intended to drive piling under the boiler house and chimney, it has now been decided to put in piles for all the foundations. The boiler equipment will probably be of horizontal tubular boilers, although that has not yet been decided upon. The steam pressure will be 125 lbs. to the square inch. The boiler house can be extended as the station grows, and the chimney is planned to accommodate 3,700-horse power in the boiler house. The first engine installed will probably be a quarter-crank or cross-compound, of 500-horse power, of a make not yet determined. For the reason above given, a second engine, probably of 1,000 or 1,200-horse power, will have to be put in, and the engine house is planned to accommodate such an engine as soon as it is demanded. The line shafts will be in the basement of the dynamo house, as in the Narragansett station. There will probably be two lines of shafting instead of a single line, and each line of shafting will drive two rows of dynamos. This arrangement should make every machine easily accessible, for there would then be five alleys down the length of the dynamo rooms between and about two pairs of machines. The boiler

and engine houses are to be substantially built of brick, and the whole station when completed will be in line with modern practice.

At the annual meeting of the Ashland (Pa.) Gas Company the following Directors were re-elected: W. H. Bright, John Dence, N. Greaber, W. A. Marr, Geo. Morgan, John B. Price, Frank Rentz, L. A. Riley and Adam Waldner.

Mr. Geo. W. Morris has been re-elected President of the Louisville (Ky.) Gas Company, and Mr. A. H. Barret succeeds himself as Vice-President.

In our issue of July 13, the fact was noted that Mr. H. Wilkiemeyer, Superintendent of the Portsmouth (O.) Gas and Electric Light Company, had resigned that position to accept the Superintendency of the Evansville (Ind.) Gas and Electric Light Company. The evening of the 6th inst. was made the occasion upon the part of his old associates at Portsmouth to fittingly express their appreciation of his services, and to bid him farewell. A local paper has the following account of the proceedings:

The affair was worked up as a surprise on Mr. W., and to further this plan a meeting of the directors and employees was called for Monday evening at his residence, on Third street, upon the pretext of formally receiving his resignation. The real object of the meeting soon became apparent, and after the transaction of a little business, the company unlimbered, and Mr. Padan, President of the Company, came forward. He bore in his hand a most artistic and elegant bronze smoker's set, surmounted with a dog's head of nearly life proportions and of "barking" presence. Upon behalf of the directors and employees he presented the souvenir to Mr. Wilkiemeyer, with the following appropriate remarks: "On behelf of the Official Board and Collector of the Portsmouth Gas and Electric Company, I take pleasure in presenting to you these articles as mementos of your faithful and efficient services. For three years you have so acquitted yourself in the discharge of your important duties as to gain the universal esteem of your co-laborers and associates. It has afforded us unfeigned pleasure and satisfaction to note the uniform courtesy of your bearing toward us during the entire period that you have served us. Scripture has taught 'The laborer is worthy of his hire.' There are two distinct classes of laborers, although the individual representatives may pass from the one to the other by insensible gradations. There is the laborer who furnishes his labor as a merchant doles out his merchandise. He has a rule or measure, and he is solicitous lest the amount of his labor outmeasures the compensation. There is no heart in a relationship of this kind. It is simply a matter of dry, hard calculation. This sort of laborer is not worthy of his hire. The other class furnish their labor as the author of nature has provided it. There has been no calculation that so many cubic inches are necessary to each individual. He has furnished it without stint, in exhaustless quantity, and has provided the mechanism for its perpetual restoration. Of this sort is the man who throws his heart as well as his brawn and muscle and intellect into the performance of his obligations. He loves to promote the interests of those whom he serves. Every thought and suggestion is loyal to his employers. He takes his monetary compensation for the quantity of mental or physical activity furnished. For the manifestation of his interest and loyalty he has that higher compensation, expressible but not measurable in terms of love and esteem between man and man. As a mark of our confidence in you and an evidence of our estimate that you take high rank in this latter class, we ask you to accept these souvenirs, accompanied with the assurance that we wish you happiness and prosperity in whatever sphere your energies may henceforth be entitled."

Mr. Wilkiemeyer was taken aback, but he presently "came to" and managed to receive the gift and to make the following reply to Mr. Padan's flattering presentation speech:

"Well, I certainly am surprised, and I cannot give expression to the thoughts that come to me, they are so many. But if I had known how hard it was to part I never should have given it one moment's attention; and as the time comes near I am feeling homesick. I have tried to do my duty here with you, and that you appreciate it you show only too well. Only I am afraid you have placed my standard higher than it deserves. The tokens that you have given to me I shall treasure, and show them to my children, and they shall treasure them all their lives, and remember them, as I will teach them to look at them, as a token of the Portsmouth people. I will try to drill into their hearts the same love that I will carry with me. I hope occasions will present themselves often that I can come here and see you; and also that our present and pleasant relationship will always exist just as it is to-day."

After Mr. W.'s brief remarks, several of the other Directors and some of the employees joined in the chorus of praise and commendation, after which the thoroughly happy party adjourned to the dining room, where the hostess had surreptitiously prepared a most elaborate feast. The evening ended with much warm handshaking and well wishes, and was finally crowned with the singing of the hymn "God be with you till we meet again."

Prevention of Firedamp Explosions.

The following is a portion of a prize essay by Mr. Austin King, Inspector of Mines of Pennsylvania:

For the prevention of firedamp explosions (1) ample means of ventilation should be furnished, always preferring it in the form of a fan, which should be placed at a safe and convenient point; (2) the work should be laid off in separate ventilation districts, giving each district a separate current of air and having a separate return therefrom to bottom of upcast, said return to be maintained solely for that purpose, and only to be traveled by mine officials for inspection purposes; (3) the overcast of air bridges should be constructed in the natural strata if the material is suitable for this work; if too expensive to construct in this way, then they should be constructed of iron in segments which should be of a known or calculated strength, so as to resist being collapsed or blown out in case of an explosion; (4) no crosscuts should be made in main heading pillars or boundary pillars of a ventilation district, except at such points as were necessary for hauling purposes; the headings should be aired as they advanced from crossheading to crossheading, or from flat to flat, by means of incombustible brattice put up for that purpose. This precaution would greatly reduce the number of stoppings to maintain airtight, or to be blown out (in case of an explosion), and would thus greatly facilitate a rescue under such circumstances. By a judicious use of this brattice in cross or flat headings the number of stoppings in them would be reduced one-half or more, with the before-mentioned advantages, and with but little or no extra cost where pillars are large and yardage is paid for crosscuts.

The fire bosses should be provided with a type of safety lamp that would combine sensitiveness in testing with the quality of resisting the passage of flame through the gauze in currents passing at high velocities. It should also be provided with a shut-off to aid in extinguishing the flame in case a large body of gas was suddenly encountered. There should also be a small key fixed to the side of safety lamp, near the top, to unlock a device fixed to roof of working place by a small wooden plug driven in a hole one inch in diameter bored in the roof with a small auger. The device would consist of an ordinary clock face, say four inches in diameter, with a circle on the outside on which the numbers 1 to 31, inclusive, were marked, and three pointers. After the workman entered his room or heading he could see that the fire boss had been there from the position of the pointers on the dial. The object to be attained by this is to furnish absolute proof that the fire boss's safety lamp has been in such a position that if any gas was near the roof he could not help seeing it. This device could be moved forward as the work advanced, according as the coal seam inclined or the condition of the roof might suggest. The fire boss could, under ordinary circumstances, make the examination and fix figures of dial in 30 seconds (the dial should always be placed in the highest point practicable in the working place). He should not be required to travel between places to be examined faster than two miles per hour. After an examination of the working places and also of those not worked in for the time being that are in any way contiguous to them or are ventilated by any air current that may afterwards pass in any place that may be worked or traveled in by workmen in the mine and all has been found safe, the fire boss should remain at the "station" and should see that no lamp passed him that did not satisfy him as to its safety.

No men should be hired to work in a mine generating explosive gases who do not possess some practical knowledge of the use of the safety lamp. The lamps furnished to workmen should be examined and tested before given to workmen to enter the mine, and should be able to withstand safely a strong current of air and at the same time give a light equal to the Clanny. No common Davy, Clanny, or Stephenson (Geordie) lamp, or lamps of like character, should be allowed to be taken into the mine, because they have been proven time and again to be unsafe and unreliable. Blasting should also be prohibited in any portion of the mine where firedamp existed or was likely to be liberated by the blast, or in the vicinity of gobs and falls that were not easily accessible to examination for the detection of gas, or where coal dust was deposited in any material quantity on the floor and sides, as the flame of the shot might be propagated by it into inaccessible portions of mine. Tamping shots with coal should also be prohibited for the same reason. The laws forbidding the taking of matches, fuse, smoking pipes or any other combustible material into mines where safety lamps are used, or the propping open of or doing damage to any door, regulator or overcast used to direct the air currents in the mines, or tampering in any way with any safety lamp, removing danger signals, etc., should be rigidly enforced.

Gas Stocks.

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July 27.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	92½	93
Central	500,000	50	—	90
" Scrip	220,000	—	95	100
Equitable	4,000,000	100	116	120
" Bonds	1,000,000	—	106	108
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	110	115
Mutual	3,500,000	100	116	120
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Standard Gas Co—				
Common Stock	5,000,000	100	—	48
Preferred	5,000,000	100	—	90
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	95	98
Citizens	1,200,000	20	78	80
" S. F. Bonds	320,000	1000	100	103
Fulton Municipal	3,000,000	100	115	120
" Bonds	300,000		100	105
Peoples	1,000,000	10	70	73
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	870,000	100	90	97
" Bonds (5's)	70,000	—	—	—
Nassau	1,000,000	25	—	140
" Ctfs	700,000	1000	98	100
Williamsburgh	1,000,000	50	110	112
" Bonds	1,000,000	—	105	109

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By Gas Company who also operate an Electric Light Plant. Must be thoroughly competent in all matters pertaining to the construction and operation of the gas works, and also understand steam and have had experience in running electric lights. Must give good references and be a worker. Address, with full particulars concerning themselves and references, also stating salary expected, GAS AND ELECTRIC COMPANY,
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POSITION WANTED
As Superintendent,

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Men Competent to Take Charge of Erection Work,

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Position Wanted

As Superintendent of Combined Gas and Electric Works,

By a young man with practical experience in details of construction, manufacture and distribution of gas and electricity. Combined plant preferred. Best of references. Will be open for engagement Aug. 1. Address
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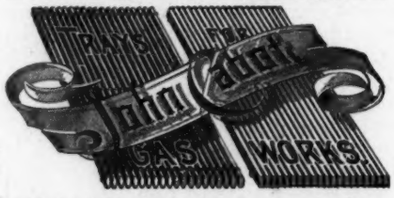

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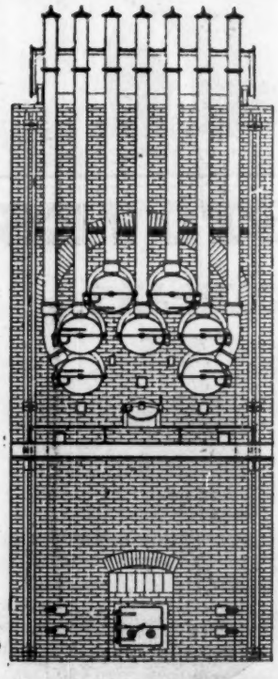

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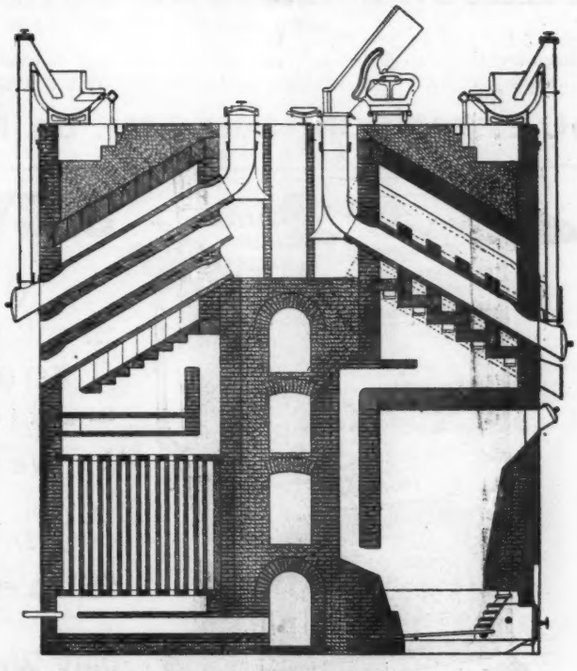

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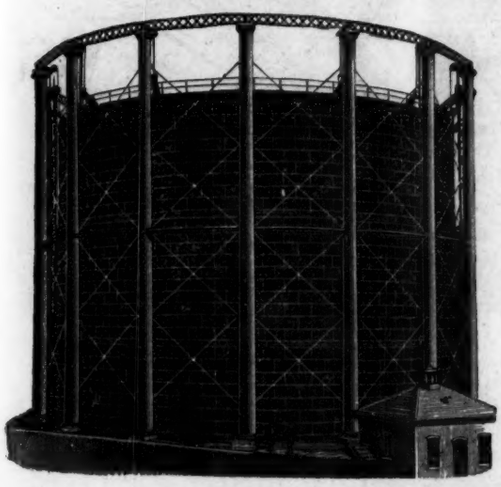

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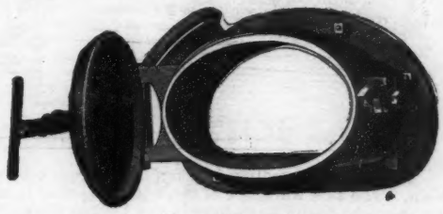

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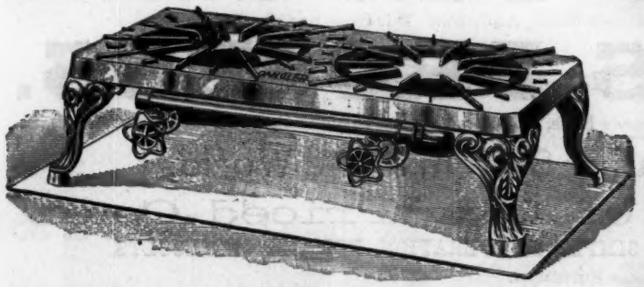

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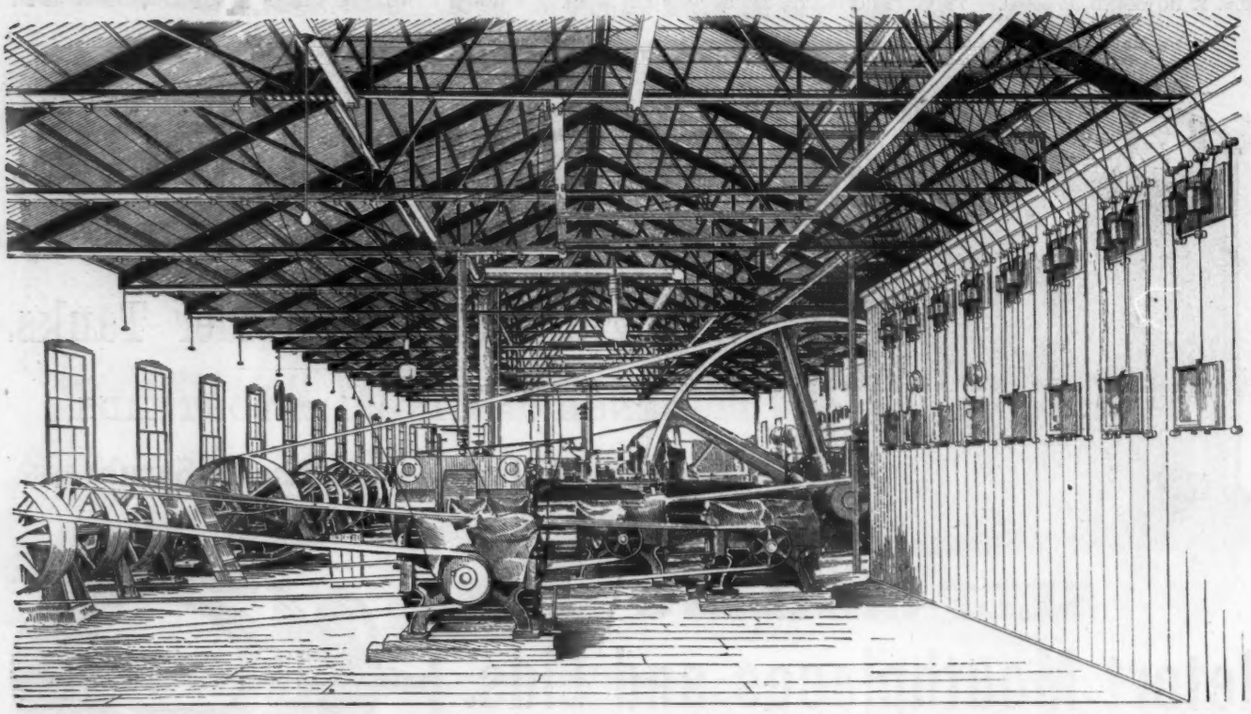

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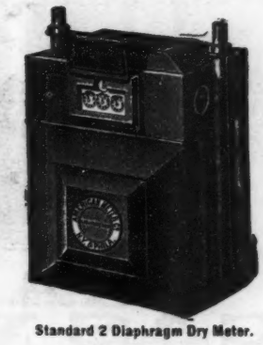

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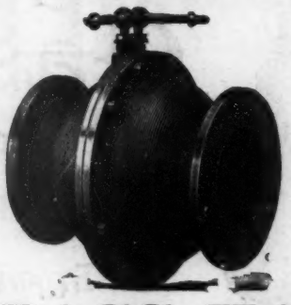

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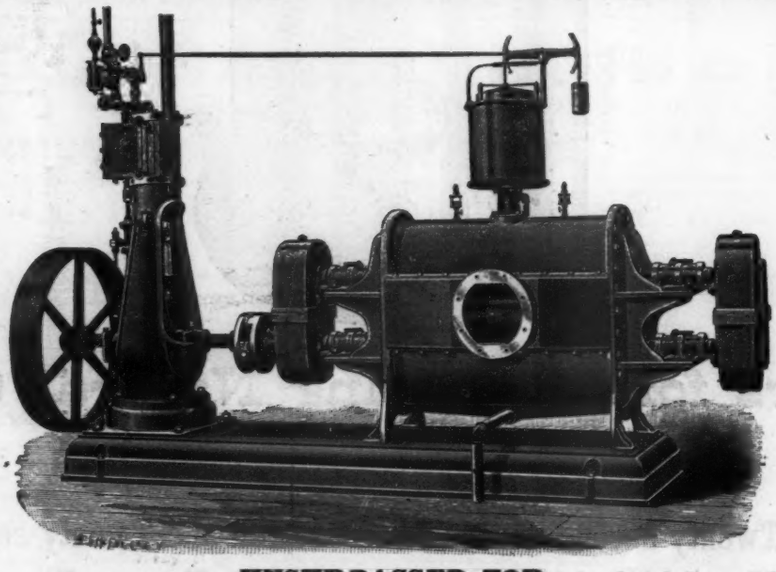

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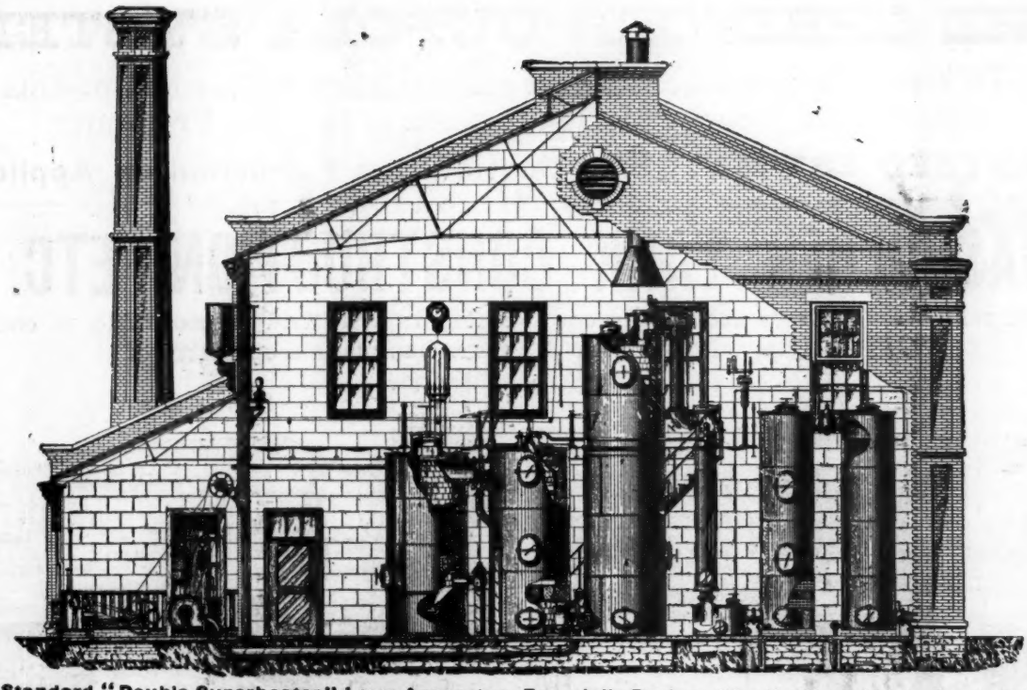

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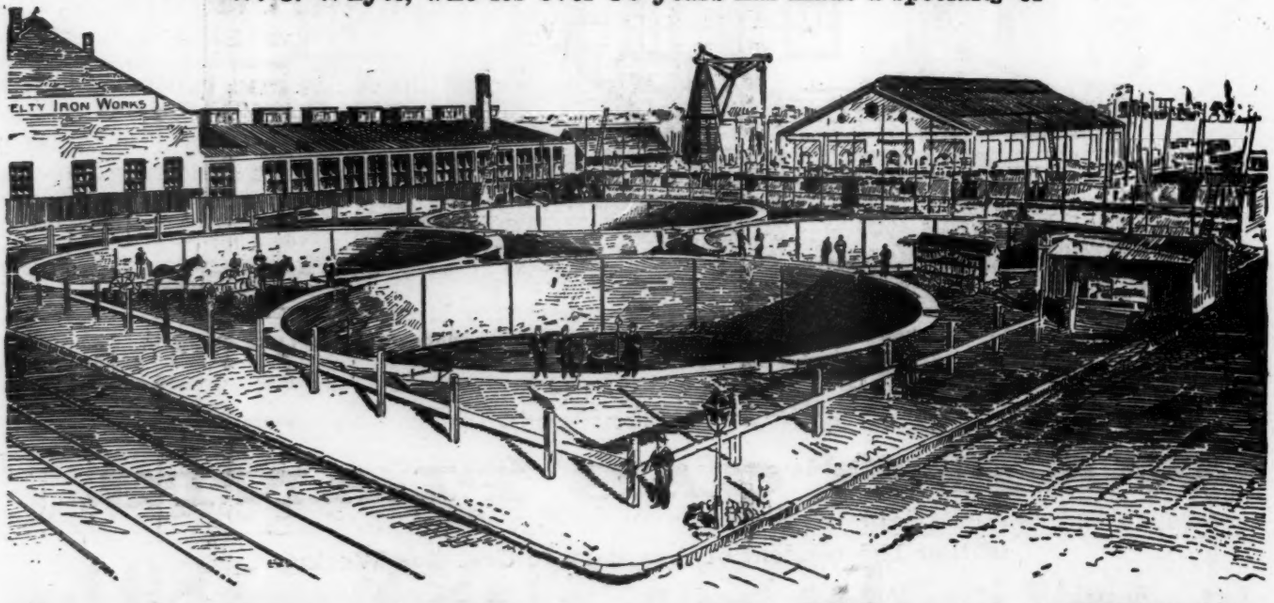

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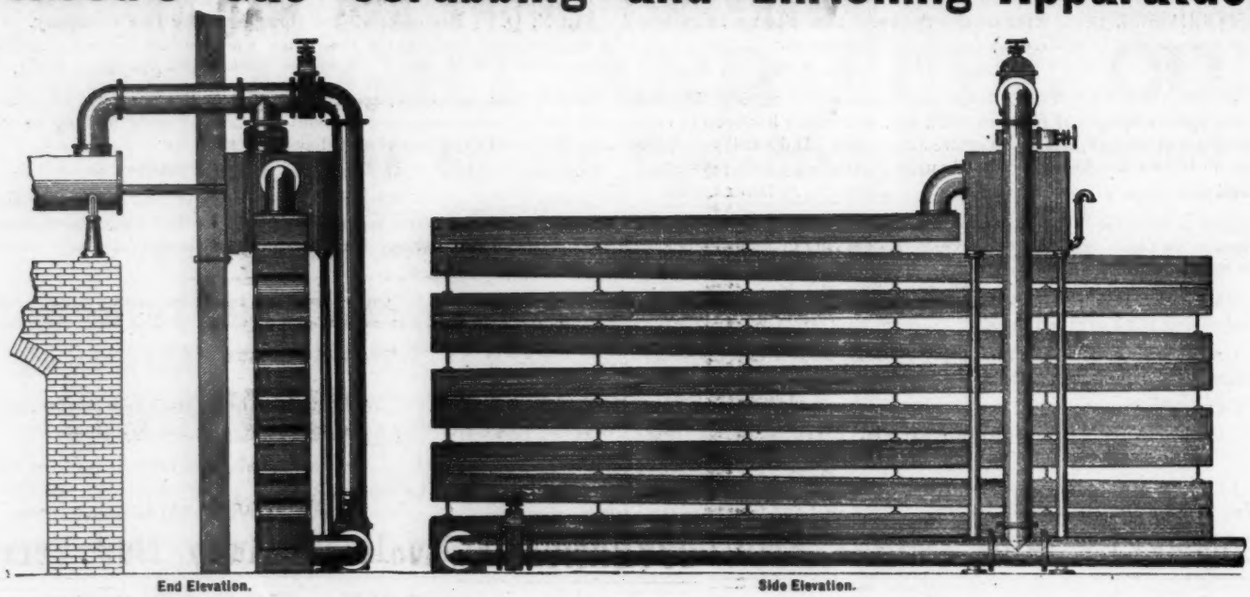

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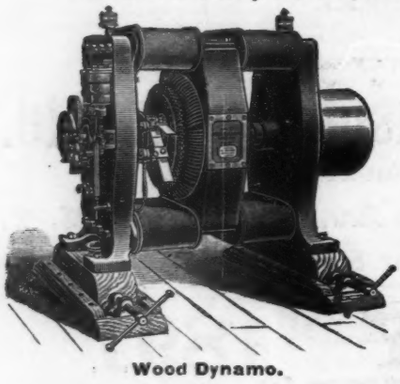

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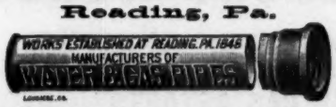

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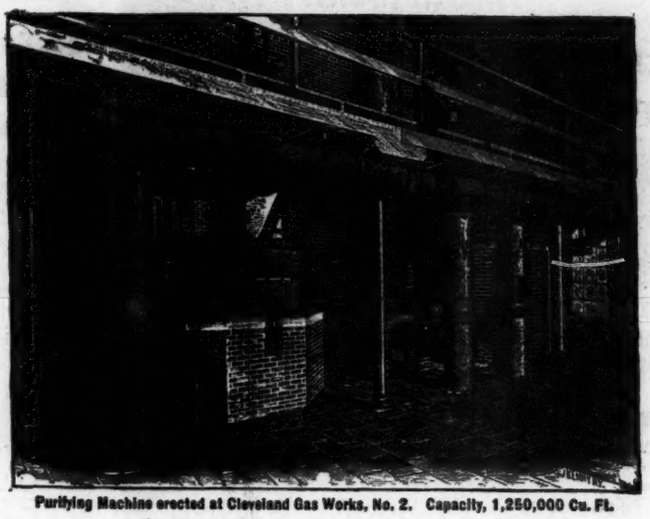

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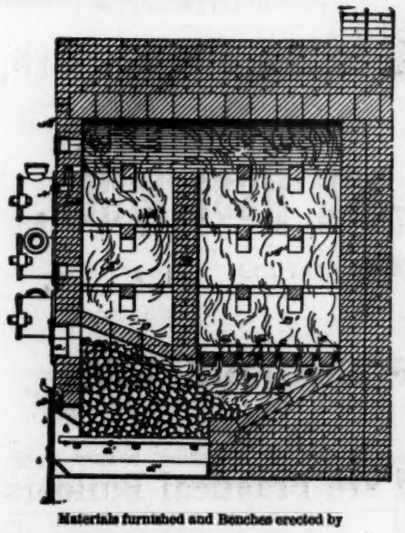

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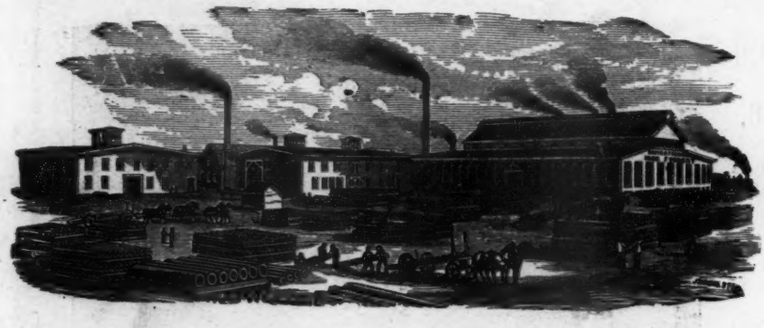

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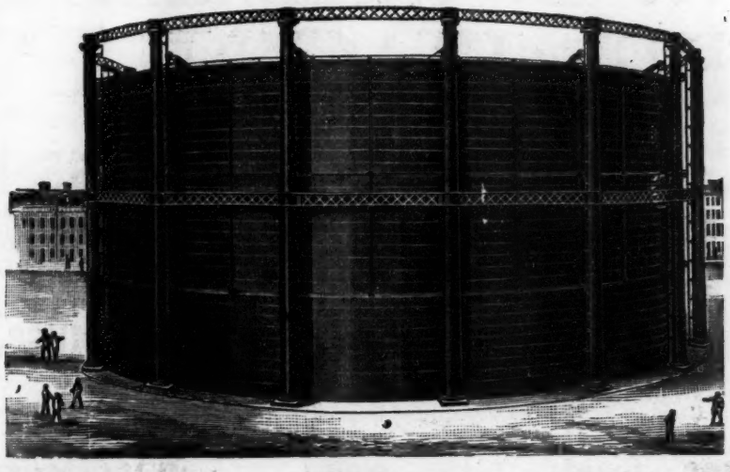

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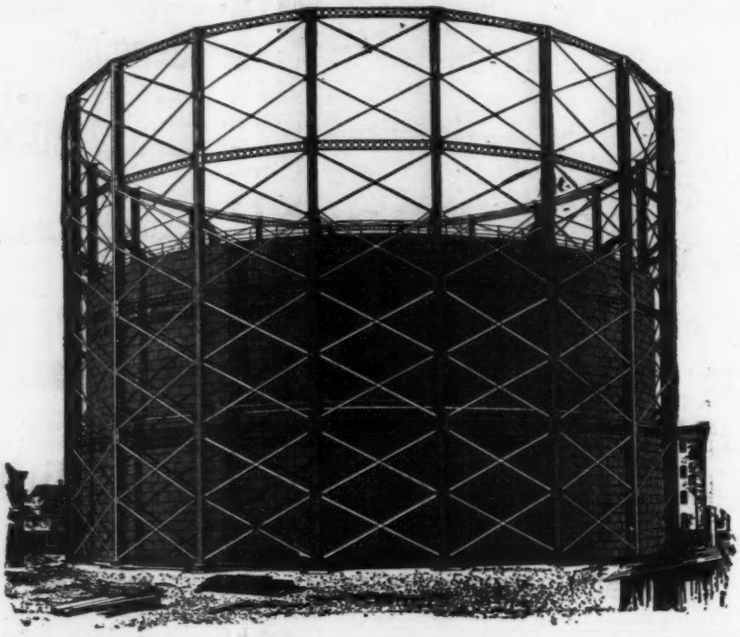

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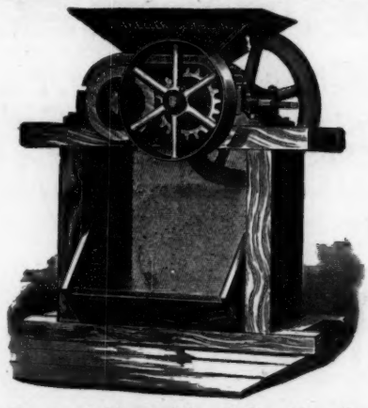

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51 Lancaster St., Albany, N. Y. 34 & 36 West Monroe St., Chicago, Ill.

STATION METERS, EXPERIMENTAL METERS, METER PROVERS, PRESSURE & VACUUM REGISTERS, PRESSURE GAUGES, ETC.

We use only the very best materials, and employ the most skilled labor, and by our long experience (37 years) and personal supervision of every deta we feel justified in assuring the public that our goods will give perfect satisfaction. Every Meter emanating from our establishment will bear the Sta Inspector's Badge, and will be fully warrented by us. Our Annual and Calendar will be sent to Gas Companies upon applicatior.

DRY GAS METERS.
STATION METERS.
METER PROVERS.
GLAZED METERS.

WE MAKE THE STANDARD GLOVER METER, FULL SIZE, FULL WEIGHT, FULL CAPACITY.

Meters of any Make Thoroughly Repaired. All Work Absolutely Guaranteed.

Exchange for all kinds of Apparatus and Appliances for making Gas. Companies having anything not in use, such as Pumps, Engines, Governors, Purifiers, Exhausters, Scrubbers, Condensers, etc., please notify us and we will endeavor to find a buyer. New Machinery furnished.

GAS PLANTS ERECTED. Correspondence Solicited.

KEYSTONE METER CO., - Royersford, Pa.

GAS INTO POWER,

BY THE

OTTO GAS ENGINE.

GAS POWER.—A Source of Revenue to Gas Companies ready to engage in Electric Lighting, building of Water Works, Electric Street Railways, etc.

Coal for producing Gas is less in amount than that for producing Steam, both being measured on an equal amount of work performed. And, further, with Gas,

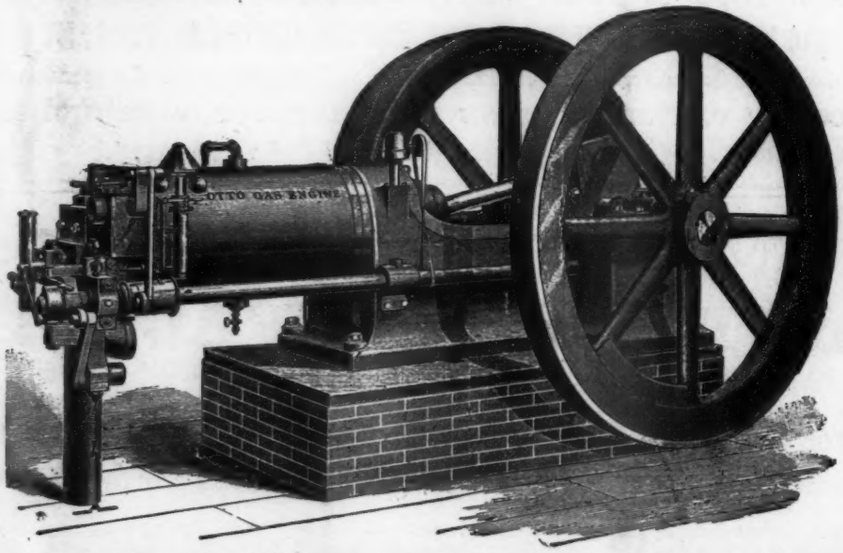
50 to 90 per Cent. of Value of Coal is Returned

by sale of Coke and Tar, according to the market value of these products.

Labor for handling fuel is **reduced,** by its becoming centralized and confined to the gas house and frequently has not increased after the addition of a power station.

With Gas Power, **cost of fuel** is strictly **limited** to the time of use.

MANY VALUABLE AND RECENT IMPROVEMENTS.



SIZES 1-3 to 100 HORSE POWER.

Wherever Gas Companies tried Gas Power with Steam Power together in one Station, the use of Steam was subsequently abandoned or restricted, and Gas Power made to take its place.

Where Gas Companies adopt Gas Power for Electric Plants, Water Works, Sewerage, etc., they not only choose **the most economical power for their use,** but secure to themselves the **numerous advantages of increased production,** without increase of expense, and benefit thereby their entire manufacture. They induce consumers, by their example, to abandon Steam for Gas Power, and, by establishing special rates, make

Gas Power the Leading Power of To-Day,

AND SOLVE AT ONCE THE QUESTION OF FUEL GAS.

"Otto Gas Engine Works,"

SCHLEICHER, SCHUMM & CO.,

151 Monroe St. (Kent Building), Chicago. **33d and Walnut Sts., Phila.**

NEW YORK AGENCY, 18 VESEY STREET.